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CONTENTS FOR OCTOBER, 1934

Original Articles

Department of Dentistry for Children

Department of Orthodontic Abstracts and Reviews

The Forum

Editorials

Book Review

News and Notes

International Journal of
Orthodontia and Dentistry
for Children

VOL. 20 ST. LOUIS, OCTOBER, 1934 NO. 10

ORIGINAL ARTICLES

ORTHODONTIA AND FACIAL ORTHOPEDIA*

PROF. C. D'ALISE, NAPLES, ITALY

THE more we progress in the knowledge of the various parts of the various organs of the human body, the more difficult it becomes to understand the fitting together of the whole. As we study the etiology of human diseases we perfect our technic and remedies, but the more do diseases and human morbidity and mortality increase. And, meanwhile, these facts, these evidences, which at first sight seem paradoxical, are but the result of our pride and ignorance. In the investigation, division and subdivision of the parts of the organs and of tissues that we make for the better knowledge of the human organism, we often lose sight of the whole organism without understanding that analytical study cannot be an aim in itself, but must serve as a means better to understand the whole, and that analysis is necessary to understand the natural synthesis.

In fact, when I consider the important studies made every day by eminent orthodontic colleagues in the research of the etiology of dentofacial deformities, and the work they do to establish the etiologic diagnosis of such irregularities, with the aim of making a better cure and to indicate their prophylaxis; when I see the new appliances imagined and constructed for their correction; the craniometric and facial measurements made in order to know better the correlations between skull and facial development, etc.; and yet observe that dentofacial deformities increase in number and degree, that their cure becomes more and more difficult, that relapses are more frequent than is believed, I ask myself: are we on the right road in the study of these diseases?

No one doubts that orthodontia in this last half century, emerging from the quackery and darkness in which it developed, has reached such scientific maturity as to place itself on a level with other specialties of medicine, so that, as it seems to me, it has even surpassed them.

*Read before the European Orthodontological Society at Paris, May, 1933.

And yet, if orthodontia is almost unknown, and thus little appreciated by physicians in general, and more especially ignored and neglected by our German colleagues, the orthopedic surgeons, it is because in the training of contemporary physicans there still exists a very grave gap, namely their ignorance of dentistry, of which orthodontia is a very important part.

Explicable, therefore, is the resentment of the American orthodontists against the law passed in the state of Arizona, as a basis of which orthodontia is separated from the dental school and entrusted to the medical faculty, and, therefore, there arose spontaneously the question: where does orthodontia belong? To orthopedics, which is a specialty of surgery, or to dentistry?

In strict terms, orthodontia should be a branch of orthopedics, inasmuch as in its etymologic sense from Greek (ορθος direct and παις child) it is the science devoted to the prevention and cure of deformities, especially in children, and should comprise then also the study and correction of the malposition of the teeth which are a part of the whole. On the other hand, orthodontia, occupying itself with the correction of the irregularities of the teeth, should be considered as a specialized branch of dentistry. But in practice we find that orthopedics occupies itself only with the study and correction of the deformities of the trunk and limbs completely neglecting the head; while orthodontia, today, with its scientific development, corrects not only the malocclusion of the teeth, but through the teeth corrects facial, and even skull deformities, and consequently the correction of malocclusion should be not only the aim of modern orthodontia, but a means to an end.

And that it is so, is proved by the fact that many orthodontists, having noted that the word orthodontia, in practice, does not correspond to the meaning we give it, have been obliged to substitute for it other expressions such as: dentofacial orthopedia, dental orthopedia, orthodontology, orthopedia of the jaws and face, orthognathodontics, orthodontics, etc.

Now, if we all work for the same end and in the same direction, why use so many different names? It is no indication of unity and progress in our thought and study, because it is not admissible that in order to express the same idea, the same conception, we can use indifferently diverse words and expressions. Every word has its correct meaning, and the function of language is to express our thoughts clearly and with precision; therefore, the use of diverse terms for the same thing is an expression of confusion and not of progress.

To face this situation it is necessary, first of all, that we agree upon our nomenclature, and as we have seen that orthodontia has as its immediate and direct aim the correction of malocclusion, it has also an indirect aim—the correction of the deformities of the face and skull. We must, therefore, call it orthopedia of the head, or more simply, facial orthopedia.

Facial orthopedia, in fact, comprises synthetically all the other terms listed above and also implies the orthopedia of the skull, because the upper part of the face forms the anterior part of the base of the cranium, and when correcting or preventing the morphologic anomalies of the face, we correct and prevent also those of the base of the cranium, as has been shown by experimental pathology and confirmed by pathologic anatomy and in the clinic.

But diversity in the nomenclature of our specialty is not our only defect; from it logically arises another: that we give orthodontia much less importance than it deserves in the general problem of the study of man.

I have already, in a critical work on contemporary medicine,* affirmed that the progress made by dentistry and orthodontia in the last half century is greater by far than we think; and this is so, first because the physicians ignoring dentistry and orthodontia have not been able to evaluate them accurately; second, because dentists and orthodontists, not knowing medicine sufficiently, have been unable to appreciate the great contribution that modern dentistry and orthodontia bring to the knowledge of the development and physiopathology of the human organism.

And today I add that the prophecy of the great American surgeon, Charles Mayo: "The next step forward in preventive medicine should be performed by the dentists," may be accomplished only when we physicians, dentists and orthodontists are convinced that no apparatus, no organ, can be well known in its physiopathology if all the others are not known in all their details and in their strict relationship to one another.

Very recent studies of human physiopathology, especially in the field of endocrinology, have given clear evidence of the functional correlation and humoral interrelation of all the organic parts that comprise animal organisms, but in practice the mechanization of man's life, its double nature, both physiologic and social, so highly developed in America, is rapidly diffusing itself all over the world, and today the sad consequences are being experienced.

Modern dentistry, though originated and developed chiefly in America through the work of specialized physicians, who considered it an integral part of medicine, was from the first boycotted by the profession at large. It was obstinately and still is persistently neglected by them, and has therefore grown autonomous, and in purely industrial and materialistic surroundings. It has endured the pernicious influence of the development of the machine age, and has been able to evaluate the great progress attained and to integrate with the other specialties of medicine for the common aim of curing human diseases and still more of preventing them.

Orthodontia, the primogenial daughter of dentistry, among all medicosurgical specialties, is the one that has almost exclusively as the aim of its studies the prevention of disease. In fact, for an organ to work normally it is necessary that its development should be normal, and facial orthopedia aims at just this —the normal skeletal development of the head and of the organs contained in it.

Now, when we compare orthodontia, in its new development and meaning, to general orthopedia as understood today, we see at once the superiority of the former over the latter, because it is the head, which, containing the brain and special sense organs, governs the trunk and limbs, and not vice versa. And it should suffice to consider the fact that on the normal development of the nasal and mouth cavities depends, in great part, the development of the respiratory

*Dentistry and Orthodontia in Medicine of the Twentieth Century (Critical notes of contemporary medicine), by Prof. Corrado d'Alise.

and digestive apparatus, to persuade oneself that orthodontia has a field of action and application that must not be ignored by physicians, and must be better known and valued by dentists and orthodontists.

The remedial work of the orthodontist is practiced as much on the deciduous teeth as on the permanent, but ordinarily it begins a little after the commencement of the eruption of the permanent teeth. However, the causes of malocclusion being multiple and complex, near and remote, the orthodontist must know all, not only for an etiologic and rational cure, but still more for correct prophylaxis.

The prophylaxis of dentofacial deformities ought thus to begin with the formation of the new being in the maternal womb; and as during the period of intrauterine life the development of the child entirely depends on the mother, and in the first year of extrauterine life, at least for nutrition, it depends also on the mother, it is on the latter that the prophylaxis must be performed.

Although during the period of pregnancy the woman is generally under the guidance of the obstetrician, and during the period of lactation under the pediatrician, it does not imply that other medical specialists cannot and must not intervene to concur in the normal course of pregnancy and lactation.

An aphorism, very frequent in contemporary life, "Every child costs a tooth," means that the contemporary woman during her pregnancy and lactation period, is often subject to alterations of the nutritive metabolism which affect not only the mother but also the child, producing in both organic and general disturbances that in the mother go under the name of osteomalacia, and in the child after birth of rickets, and of which the maternal dental disturbances are but the most frequent symptoms and those which more easily attract the attention of the woman.

Now, the dentist who has a complete general medical knowledge should not limit his work only to the cure of teeth, but also, and above all, to a general etiologic cure, in collaboration with other medical specialists, in the mother first, and in the child after its birth.

But such collaboration should not be entered into as it is today by the great majority of dentists and physicians, considering man as a physical machine; but rather bearing in mind that he is a biologic organism; that the one, the physical machine, is the creation of man, while the other is the most beautiful and complex creation of God; that the first is composed and functions by union of different pieces put together and constructed separately, while the other is born complex and complete, and on separation of its parts dies.

Consequently, we note that each day furthers the idea of the necessity of preparation in general medicine and surgery as the fundamental basis of the different branches of the healing arts, from which then should germinate the different specialties, always kept, however, in constant relation among themselves.

Recently, in Bulletin No. 19 of "The Carnegie Foundation for the Advancement of Teaching," an attempt is made to demonstrate the utility and necessity of the autonomy of dentistry from medicine, but it is unconvincing and though I must for want of space refrain from being critical, I will refer to

a publication. *Future Dental Education,* by Bland N. Pippin, D.M.D., St. Louis, issued in the INTERNATIONAL JOURNAL OF ORTHODONTIA, August, 1932, and sent to deans and leading medical men of some of the great medical schools and clinics in the United States. This article not only contains a criticism of the above-mentioned Bulletin, but reports the answers to a questionnaire, regarding the fact long known to dentists, that the basic sciences of medicine are indispensable to dentistry, and that the fundamentals of dental science are equally necessary to medicine.

To be brief, I quote only the conclusion, namely: "In view of the trend of thought expressed by many leading medical authorities as well as dentists, I confidently believe that the time is not far distant when for the better service of mankind, dentistry with medicine must be united into one scientific body—one profession inseparable"; and the answer of the surgeon, Charles Mayo, who says: "Much as we might desire dentistry to be reattached to medicine, and thus become one of its greatest specialties, I do not believe it can be accomplished at the present time. Nearly all of the present teachers of dentistry are educated in dentistry but not in medicine. In years to come the alumni of the dental schools may force the schools to have professors educated in medicine as well as dentistry. When this is accomplished medicine and dentistry may at last become more closely associated. For the time being we must endeavor to secure greater cooperation between medical men and dentists in the study of chronic and recurring diseases."

This is a very significant answer, with which I partially associate myself, but I think that the request that the professors of dental schools be educated in medicine as well as dentistry cannot come from the alumni, who will be in a position to know the defects of teaching in dental schools only when they enter into professional practice, but such request should come from the faculties of medicine as well as of dentistry, which should provide at once for such a change.

A NEW ORTHODONTIC MECHANISM: THE TWIN WIRE ALIGNMENT APPLIANCE*

JOSEPH E. JOHNSON, D.D.S., F.A.C.D., LOUISVILLE, KY.

DURING the many years I have been predetermining tooth movement with amalgam models, using the method shown in Fig. 1 which I described before the American Dental Association in 1925, no facts struck me more forcibly than the small amount of movement needed to correct the average malocclusion and the necessity of securing bodily movement of the anterior teeth. Often I have thought how gratifying it would be to possess an appliance which automatically would move teeth to normal positions. Now, after several years of experimenting, I have perfected the twin wire alignment arch. This arch is simple in construction, is easier to use than the old alignment arch and performs its function much better.

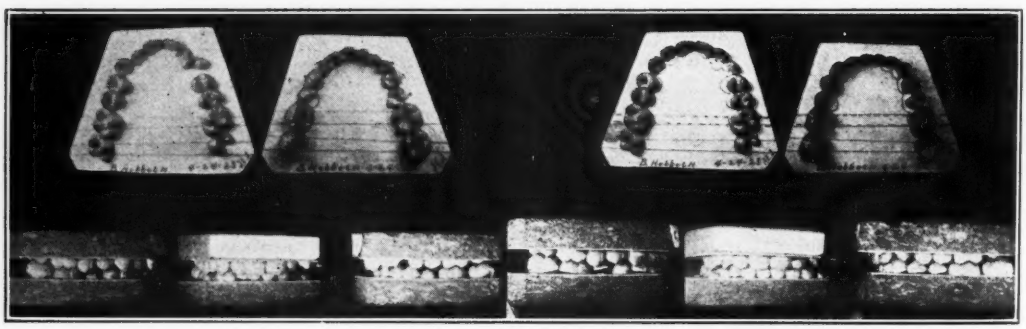

Fig. 1.

The twin wire automatic appliance is made up of two small wires, of hard stainless steel, 0.010 inch in diameter. The wires are passed through end tubes (Fig. 2), the double end being drawn into one tube as in *D*, Fig. 2, the opposite end through the other (*C*, Fig. 2) and then cut to the required length. After cutting, the ends are crimped and the wire is drawn back into the tubes. Friction holds the wires in place. I found it difficult to draw the wires through the tubes for any great distance and at the same time keep them in accurate alignment, so I secured the cooperation of the manufacturer and the arches are now made in six sizes—three maxillary and three mandibular (Fig. 3). The end tubes are of one size, one and one-sixteenth inches long and 0.043 inch diameter.

The tubing is drawn from an especially hard precious metal alloy and has the strength of 0.040 iridioplatinum arch wire. Strong end tubing is essential to the proper performance of the appliance. A weak tube would bend and throw all the downward pull of the intermaxillary rubbers upon

*Read at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, Okla., Nov. 8-10, 1933.

the anterior teeth when these rubbers were used. In deep overbite cases, this is the opposite to the required direction. To prevent it, I was forced at first to use heavier twin wires. Now, with these strong end tubes, I use 0.010 inch wire entirely.

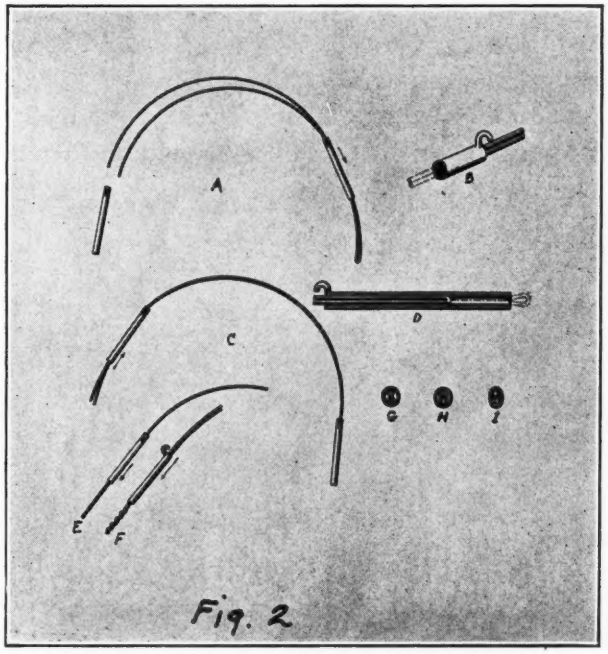

Fig. 2.

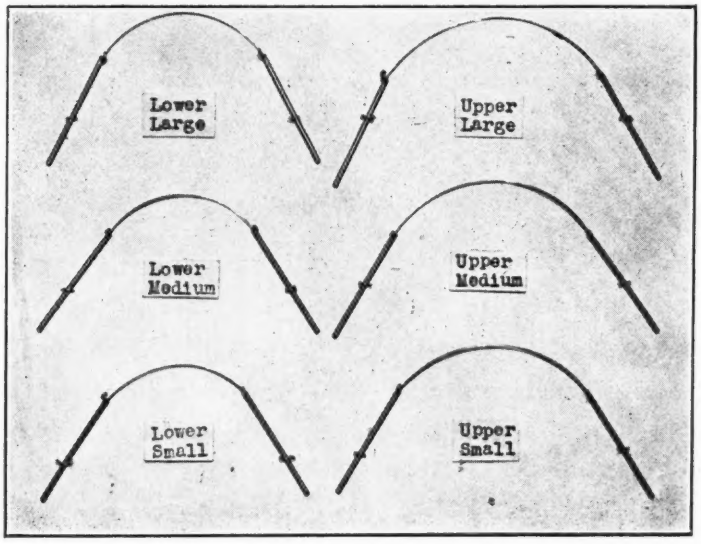

Fig. 3.

The ends of the wires are drawn into the end sections one-half inch from the distal end of the tubes. This permits cutting off the correct length for the case. It allows making them short enough, even when deciduous molars are used for anchorage. The six sizes of the midsection, or steel wires, were

determined upon after measuring one hundred models. I am confident that they will meet the needs of any case.

The important advantages of two small wires over one heavy wire are:

(1) A small wire is more resilient than a large one. An extremely small wire gives us the resilience necessary to cause the arch to spring back into its original shape when forced into the locks on the teeth. A single small wire would have insufficient power to move the teeth, and so we double it to take advantage of its springiness while multiplying its force by two. When a twin wire is bent into the shape of the normal arch and sprung into the locks, the teeth move automatically into their position in a normal arch.

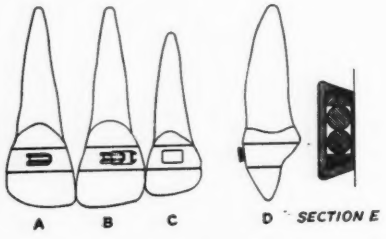

Fig. 4.

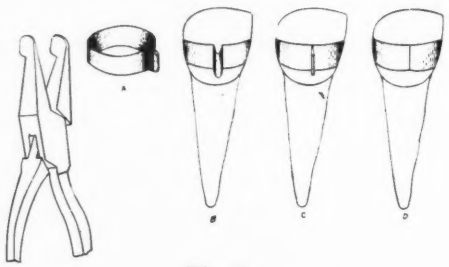

Fig. 5.

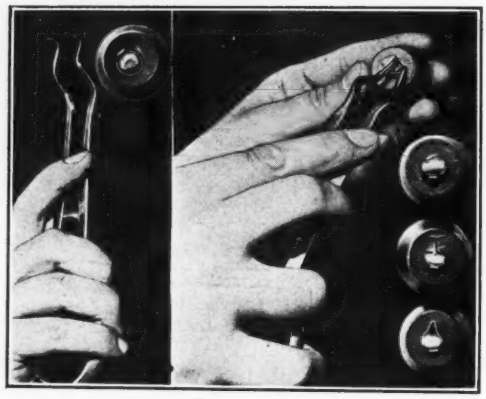

Fig. 6.

(2) The twin arch wires move the teeth bodily, when fastened to them by a locking device. This cannot be done with a single wire.

The type of arch I am describing cannot be used ligated to the teeth with wire or grass ligatures. The locking device (Fig. 4) is needed. The male part is welded to the band. It has parallel walls forming a channel in which the twin wires are to be seated. The outside wall is dovetailed. The female part slips over it and fits very closely, holding its place by friction. The locks are $\frac{1}{8}$ inch long, $\frac{1}{16}$ inch wide and $\frac{1}{32}$ inch thick. They are supplied welded to bands similar to my loop molar band (Fig. 5). The loop provides quick and accurate fitting. With the three standard sizes, any anterior or premolar tooth can be fitted. This eliminates the stocking of a large assortment.

However, in Fig. 6 a much easier and better way of drawing the bands around the teeth is shown. It is so simple that it is almost as easy to make a band as it is to tie a wire ligature around the tooth.

Briefly, this is the method I am now using: Instead of the band's having a loop, it is made a plain seamless band. It is slipped on the tooth to its correct position, *B*, in Fig. 6, then with an old-fashioned dam clamp forceps, *A* in Fig. 6, which has one of the beaks shortened and flattened to rest against the incisal edge of the tooth.

The handle of the dam clamp forceps is compressed, which opens the beaks, and the band is drawn tightly around the tooth *A*, Fig. 6. Then with a pair of Howe pliers the loop portion of the band is pinched together, removed, soldered, excess trimmed off; and a well-fitting band is ready to be cemented to the tooth.

These bands are made in three sizes and two widths, that is $\frac{1}{8}$ and $\frac{3}{32}$ of an inch. I use the narrow bands entirely. They have the following ad-

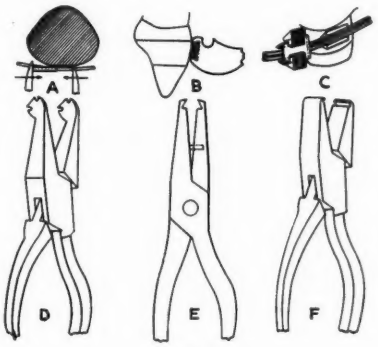

Fig. 7.

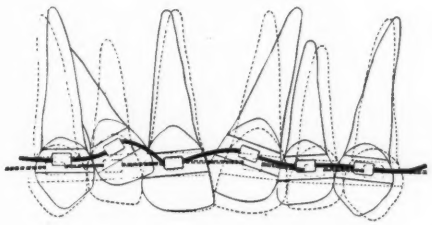

Fig. 8.

vantages over the wider bands: (1) They are much more esthetic. It is surprising how much difference $\frac{1}{32}$ of an inch makes in the appearance of a band. (2) They conform much more readily to the contour of the tooth, which makes them much easier to fit. (3) They do not interfere with the contact point. (4) When it is time to recement them, they are readily removed without tearing; and still if they are properly fitted to the tooth, I have no trouble with their coming off.

If a band is correctly fitted, the lock is at right angles to the long axis of the tooth and should be placed on it in such a position that when the teeth are moved in their correct position, the locks will all lie in the same plane.

Pliers *D* and *E* (Fig. 7) are used to seat the twin wires. The *E* pliers picks up the female part and starts it over the male *C*. (Fig. 7.) It is furnished with a stop which permits slight tightening of the female part. The *D* pliers is used to complete the seating. It has two grooves in the beaks, one for maxillary and one for mandibular teeth. The twin wire alignment arch fits these grooves. When the beaks are closed, the female part is forced over the male (*A*, Fig. 7). In removing the lock, the procedure is reversed. How

the wires fit the grooves is shown in *B* in Fig. 7. End tubing is manipulated with *F* pliers which has a 17 gauge groove in the beaks.

The twin wire appliance automatically moves both crowns and roots labially, buccally, lingually, mesially, distally, torsally, occlusally or gingivally. The labial and incisal views (Figs. 8 and 9) show the manner in which these movements are obtained. The heavy dotted lines represent the twin wire alignment arch as it lies passively against the teeth. When sprung into position on the malposed teeth and locked, its resilience is so great that the teeth are moved to the place where the wire rested originally. In this way, they are carried to normal position, represented by dotted outlines of teeth. Notice that both crowns and roots are moved.

Fig. 9 shows an incisal view of the same malposition as Fig. 8. When the twin wires, represented by the dotted line, are sprung down and locked, the malposed teeth are rotated into position. It must be mentioned that while

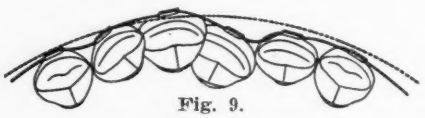

Fig. 9.

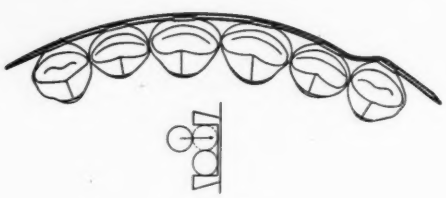

Fig. 10.

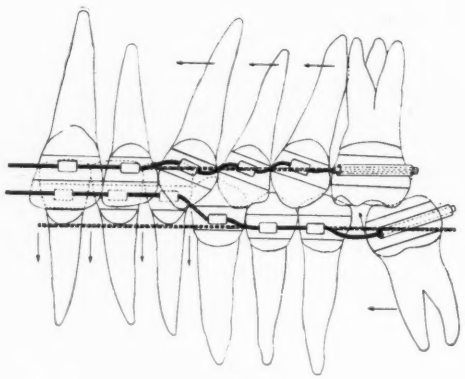

Fig. 11.

the wires fit the channel of the lock accurately, there is still enough play to allow the tooth to slide along them mesially or distally. This is necessary in order to gain enough room to rotate the tooth. If this sliding should not be desired, a drop of cement is put into the female part before it is slipped over the male. This is very important. Frequently, when anterior teeth are being moved labially, they will slide along the wire and become separated. It is necessary to cement the locks, too, if space is to be regained, as in cases of impacted canines.

With the arch wires measuring 0.010 inch and the seat of the lock 0.011 inch, enough play exists to allow individual tooth movement instead of a rigid locking of tooth to arch. The smallness and resilience of the twin wires conspire toward the same desirable end.

If a decided forward tipping of the apices of the teeth is desired, the top strand of the twin wires is made longer (Fig. 10) so that when the lower strand is seated in the lock, the upper will stand away from it. When forced into position, the top strand will exert more force than the lower and cause the apices to move forward more rapidly than the crowns.

I do not advocate the use of this appliance to widen the arch in the premolar and molar regions, because I believe the result can be secured much more easily and better with a lingual appliance. In some few cases, where the crowns of the canine and premolar are tipped forward (Fig. 11), the apices of the teeth can be tipped forward very readily and the teeth brought into perpendicular position. The appliance is very useful too in straightening tipped molars and in closing the space caused by the loss of a tooth in the mandibular arch (Fig. 11). Excessively extruded anterior teeth can be depressed with it if the twin wires are made to lie gingivally and then sprung up into the locks (mandibular anterior teeth, Fig. 11).

Fig. 12 illustrates how I obtain anchorage on molar teeth. This can be done in two ways. In Fig. 12 *A*, a lingual appliance is used to stabilize the anchorage. Since the twin wires are so small in gauge, their pressure is too gentle to affect the molar. In cases where a lingual appliance is not desirable, for example, where we wish to move the molars distally, the twin wire appliance is locked to the anterior teeth, the ends are bent to lie passively over and parallel to the tubes on the molar bands as in Fig. 12 *B*. The appliance

Fig. 12.

is then removed, coil springs are placed over the end tubes, and the appliance is locked to the anterior teeth. This method is exceptionally effective in moving molars distally.

Fig. 13 shows how widely spaced central incisors are drawn together. In these cases, frequently the roots are tipped toward the median line and the crowns are divergent. This condition is automatically corrected by the twin wire appliance. The normal alignment arch is represented by the dotted lines. Sprung into position, it assumes the position of the heavy lines. The resilience of the wires causes the apical ends to move apart and the mesio-incisal edges to move toward one another. Since the twin wires slide through the locks, a silk or wire ligature is used to draw them together. An incisal view of *A* is shown in Fig. 13 *B*. It illustrates how the rotation of the central incisors is carried on at the same time.

Some teeth are so irregular that it is not advisable or even possible to seat both wires in the lock at the beginning of the treatment. Fig. 14 *A* shows the two methods for elongating teeth. We must avoid drawing down a tooth too quickly. Instead of placing both wires in the lock, only one is so placed, as on the right central incisor. When this gentle pull has elongated the tooth quite a bit, the other wire is placed in the lock and the tooth brought to

normal position. This method was used in the case shown in Fig. 19. Another way is to run a 0.010 inch wire ligature through the lock and tie it to the twin wires (see canine, Fig. 14).

Often a tooth is so badly rotated that it is not advisable to seat the twin wires completely. To avoid too great pressure, the female part is seated only about two-thirds of the way (Fig. 14 *B*). In two or three weeks, after the tooth has been somewhat rotated, the female part is completely seated. There are instances where a tooth is so far out of line that it is not possible to detach

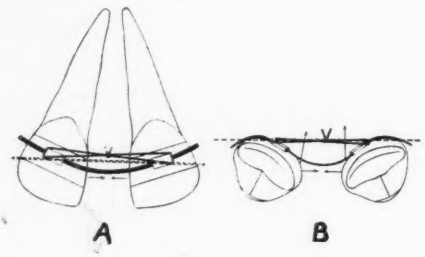

Fig. 13.

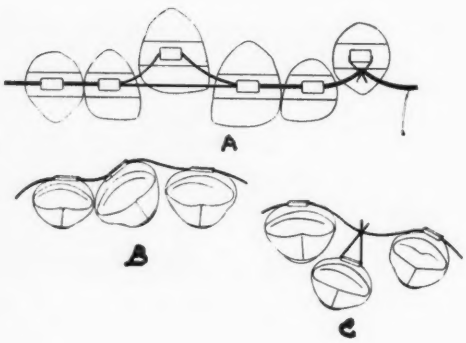

Fig. 14.

Fig. 15.

the female part after the band is cemented. This is the case with the lateral incisor, in bad lingual occlusion, shown in Fig. 14 *C*. In such cases, the female part is slipped over the male before the band is cemented to the tooth. A 0.010 inch wire ligature is passed through the lock and secured to the twin wire. When the tooth has been moved out so that it is possible to detach the female part, proceed in the usual way.

When I began using this appliance, I was astonished and alarmed at the rapidity with which the teeth moved, although the patients did not complain of discomfort nor did radiographs show absorption of roots or alveolar process.

I determined to find out just how much pressure I was employing; so I designed the scale, shown in Fig. 15, which measures the force exerted upon the tooth. The end of the scale's stem is grooved, and when twin wires, represented by the dotted line, are seated in the lock upon the lateral, the amount

Fig. 16.

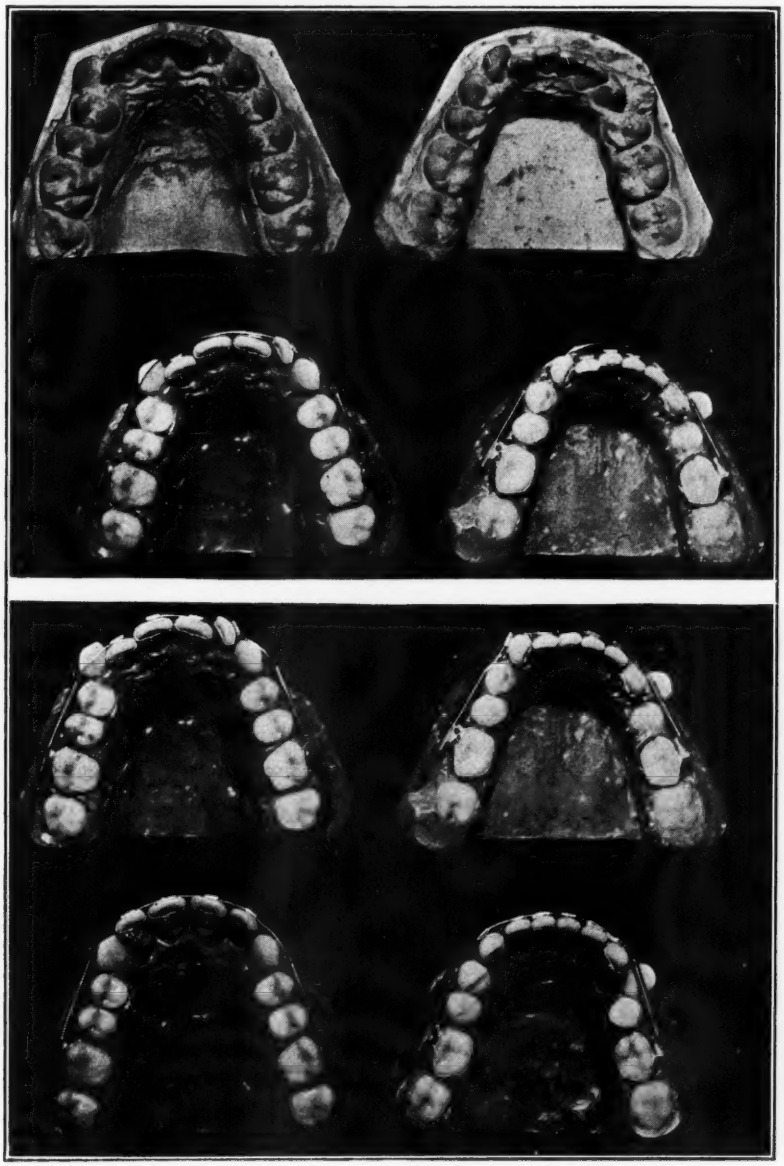

Fig. 17.

of force exerted is registered. To my surprise, I found the average pressure to range from two to ten ounces, depending upon the irregularity of the tooth. By the same method, I discovered that a 0.010 inch ligature, ligated to an 18 gauge arch wire, often exerts pressure of from two to four pounds. From this it will be seen that the twin arch appliance exerts a very gentle force, but it is constant and the teeth are moved very rapidly and without discomfort.

The same scale may be used to determine the pressure of finger springs, lingual arches, coil springs, rubber bands and other devices. These scales opened my eyes to the amount of pressure exerted by some of the appliances in common use today.

Fig. 16 illustrates an interesting experiment which will show very clearly the working of the twin arch appliance. An impression of the plaster model is taken in negocol. I use negocol both because it reproduces the model very accurately and because beeswax may be poured into the impression and separated without difficulty. Porcelain rooted teeth are placed in the negocol impression. Beeswax, to which a small amount of rosin has been added for hardness, is poured into it. I use beeswax because it does not adhere to the porcelain when the tooth is moved. The amount of movement is clearly shown in the wax.

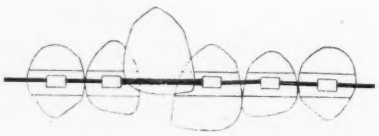

Fig. 18.

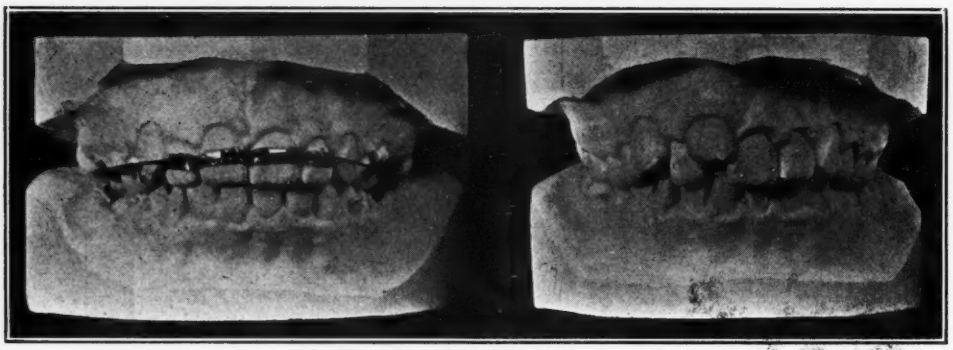

Fig. 19.

The lower group (Fig. 16) shows the wax models. Notice how the arch wires lie in relation to the teeth. Fig. 17 illustrates the twin arch fastened to the teeth.

After placing the wax models in lukewarm water, it is intensely interesting to watch the teeth moving into position to form a normal arch. The lower pair (Fig. 17) clearly shows the amount of tooth movement which has taken place through the two adjustments of appliance. The same amount would occur in the mouth, of course, over a long period of time. It is undisputed that as long as there is pressure upon a tooth, it will continued to move.

In Fig. 18, the method employed in opening spaces for partially erupted and unerupted teeth is shown. A coil spring of 0.009 inch stainless steel wire, fitting over the twin wires, is stretched quite a bit longer than the space between the locks on lateral and central incisors. The female parts are forced into position, compressing the spring. Since the twin wires slide through the locks, the teeth are bodily moved apart.

A case treated in this way is shown in Fig. 19. The right lateral and left central incisors were compressed at the time the right central incisor was brought into position. The results accomplished required six months. With all the cases I am about to show, the results obtained took the same amount of time or less. I find it necessary to recement the bands every six months. These models, with the appliances upon them, were made at the time the bands were recemented, at the end of this lapse of time.

Fig. 20.

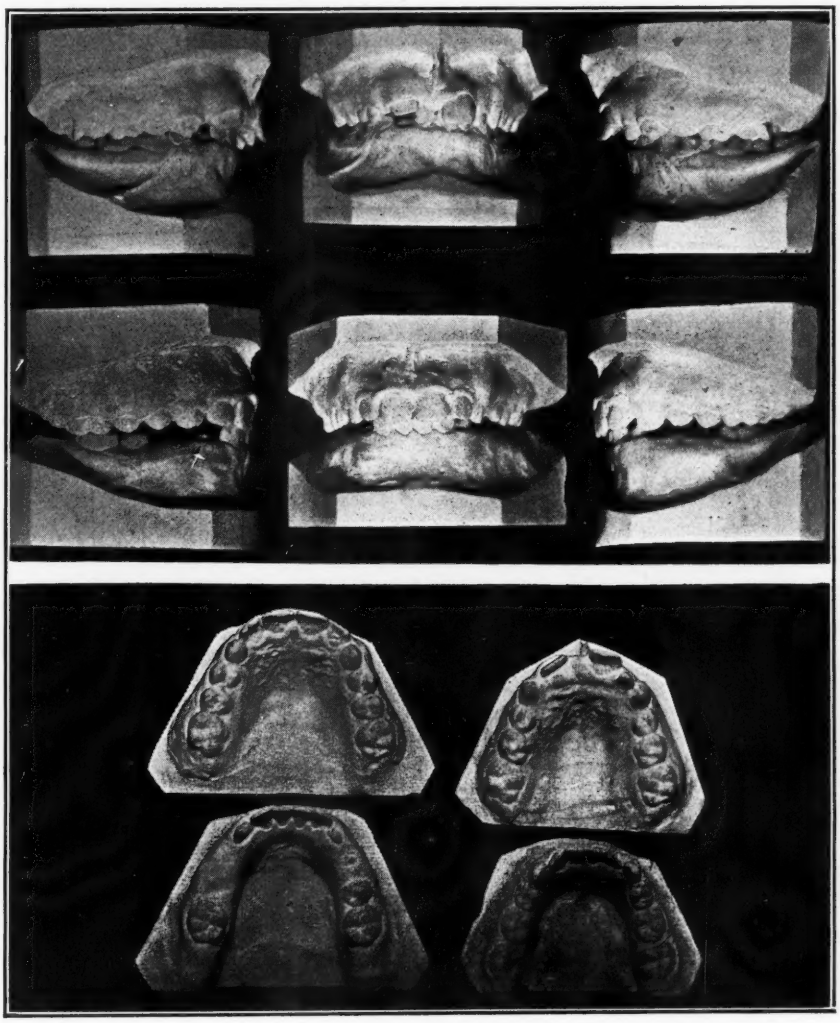

Fig. 21.

Fig. 20 is a case in which the reverse tooth movement was obtained from that in Fig. 19. There is quite a space between the central incisors, and the right central incisor is only partially erupted. This condition was due to a supernumerary tooth between the two central incisors. The right tooth was elongated and moved along bodily on the twin wire by means of grass and wire ligatures. This case could have been handled with a 0.009 inch coil spring, resting against the right end tube and against the lock upon the right central incisor. The lower models show the case at the present time. Let me

point especially to the upright position in which the right central incisor was moved and the correction of the deep overbite and the distoclusion. Fig. 21 is a lingual "before and after" view of the same case.

The lower models in Fig. 22 show an appliance for moving the first molars distally when they have drifted forward and closed the space of the second premolar. Observe that I use coil springs on the end tubes, and, since the appliance is locked rigidly to the anterior teeth, the molars cannot tilt but move distally in an upright position. Frequently, in this type of case, the twin wire is formed to fit gingivally and then is sprung down and locked

Fig. 22.

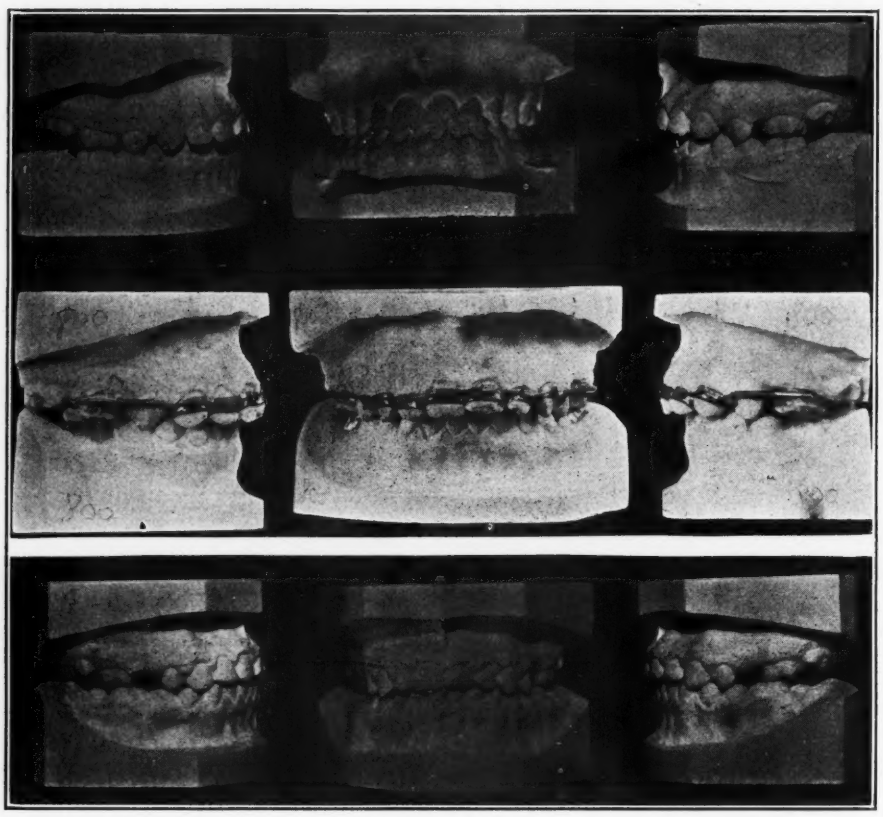

Fig. 23.

into position. This upwardly operating force will counteract the downward pull of the intermaxillary elastics and prevent elongation of the anterior teeth.

Fig. 23 is the case after six months' treatment, at which time the appliances were removed and a Hawley retaining appliance was placed upon the maxillary arch. The patient had worn a lingual appliance upon the mandibular arch. This was removed, because the mandibular arch had been used only for anchorage.

The results of six months' treatment of a distoclusion case, complicated by the loss of the mandibular left first molar and the absence of the maxillary left canine, are seen in Fig. 24. Notice that the root of the right central

incisor has been tipped toward the median line. Fig. 25 shows the same case after the twin arch appliance had been removed and a Hawley retainer placed upon the maxillary arch. This patient has been wearing this for about six months, and I see no tendency to distal drift.

A typical unilateral distoclusion, with a tendency to open-bite is shown in Fig. 26. I started treatment with the regular 18 gauge alignment arch. The open-bite continued to get worse and the lateral incisors erupted rotated. The boy was a difficult patient to handle, and it looked as though the case would be a failure. I decided to try the twin wire appliance. The center

Fig. 24.

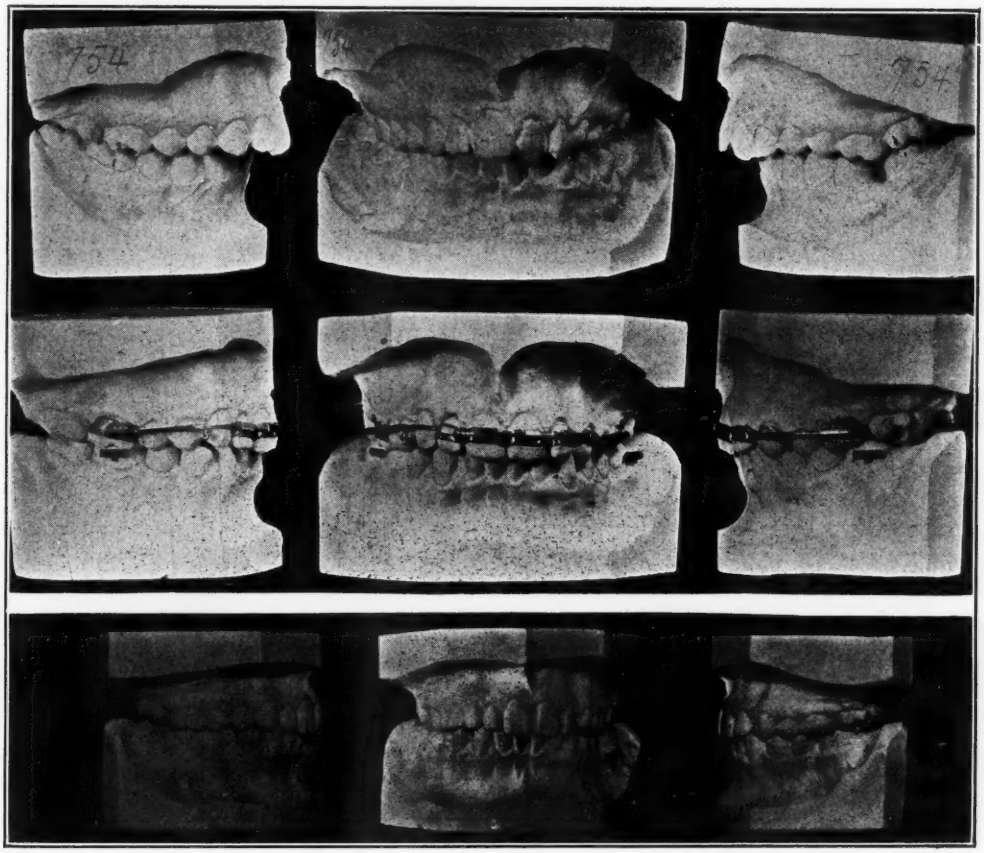

Fig. 25.

model shows the results after six months, the model at the right after ten months. This was one of the first cases in which I used the new appliance.

Let me add that children who give trouble, when required to wear wire or grass ligatures, become tractable when the twin wire arch is used. It does not annoy them, because the locks present smooth surfaces to the lip. The appliance is very easy to keep clean.

Fig. 27 shows the results obtained in an open-bite case in six months. Notice particularly the amount of lengthening secured on the maxillary lateral incisors. The mandibular incisors, too, have been brought up to some extent. These show no absorption of roots or alveolar process and that no

pulps were destroyed. A strange thing occurred in this case. When I removed the mandibular appliance, I found that the mandibular left central incisor had turned dark. I was sure the pulp had been destroyed. Strange to relate, three months later normal color had returned and the tooth responded to the pulp tester. I cannot account for it, but it certainly happened. This is the only instance, in my experience, where any suspicion of injury to pulp occurred.

Fig. 28 is a case which I diagnosed as a drifting forward of all the maxillary teeth, complicated by deep overbite and crowding of the mandibular anterior teeth, and drifting forward of the mandibular molars and second premolar on the right side. The appliance used is shown in Fig. 29. Coil springs were used over the end tubes of the maxillary appliance with intermaxillary elastics to keep the maxillary anterior teeth from moving labially.

Fig. 26.

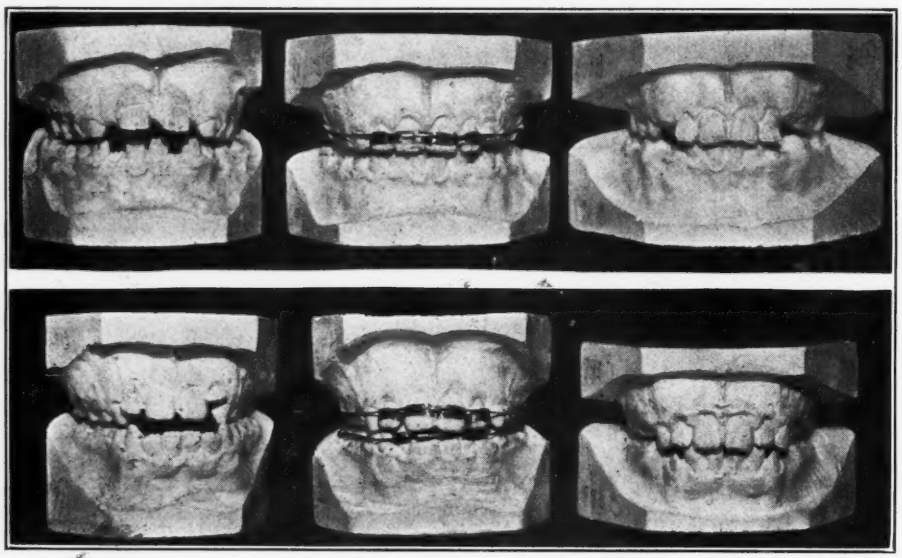

Fig. 27.

The lower models are views of the case after six months' treatment. You will notice that a normal mesiodistal relation has been obtained, that space for the mandibular right canine has been gained and that the mandibular teeth have been placed in good alignment. These improvements were accomplished with only three readjustments of the twin wire arch. In fact, in all the cases I have shown the results have been brought about by two or three adjustments. Fig. 30 is the present aspect of the case. A Hawley retainer is being worn at night on the maxillary arch and a lingual appliance on the mandibular arch.

Fig. 31 represents the case of a boy of fifteen years, with the four anterior incisors biting lingually and a tendency to mesioclusion on the right side. The twin wire appliance was adjusted to the four anterior teeth. Then, coil springs of 0.010 inch were placed over the end tubes. An appliance was placed

Fig. 28.

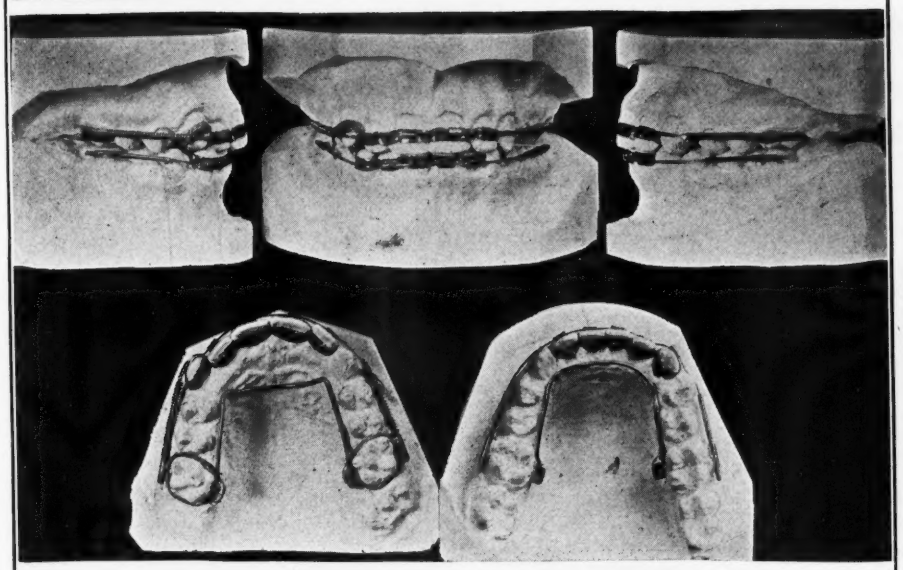

Fig. 29.

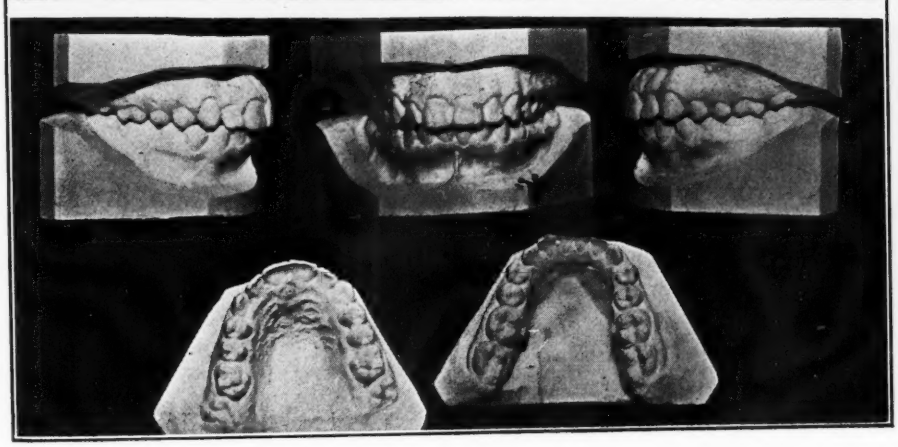

Fig. 30.

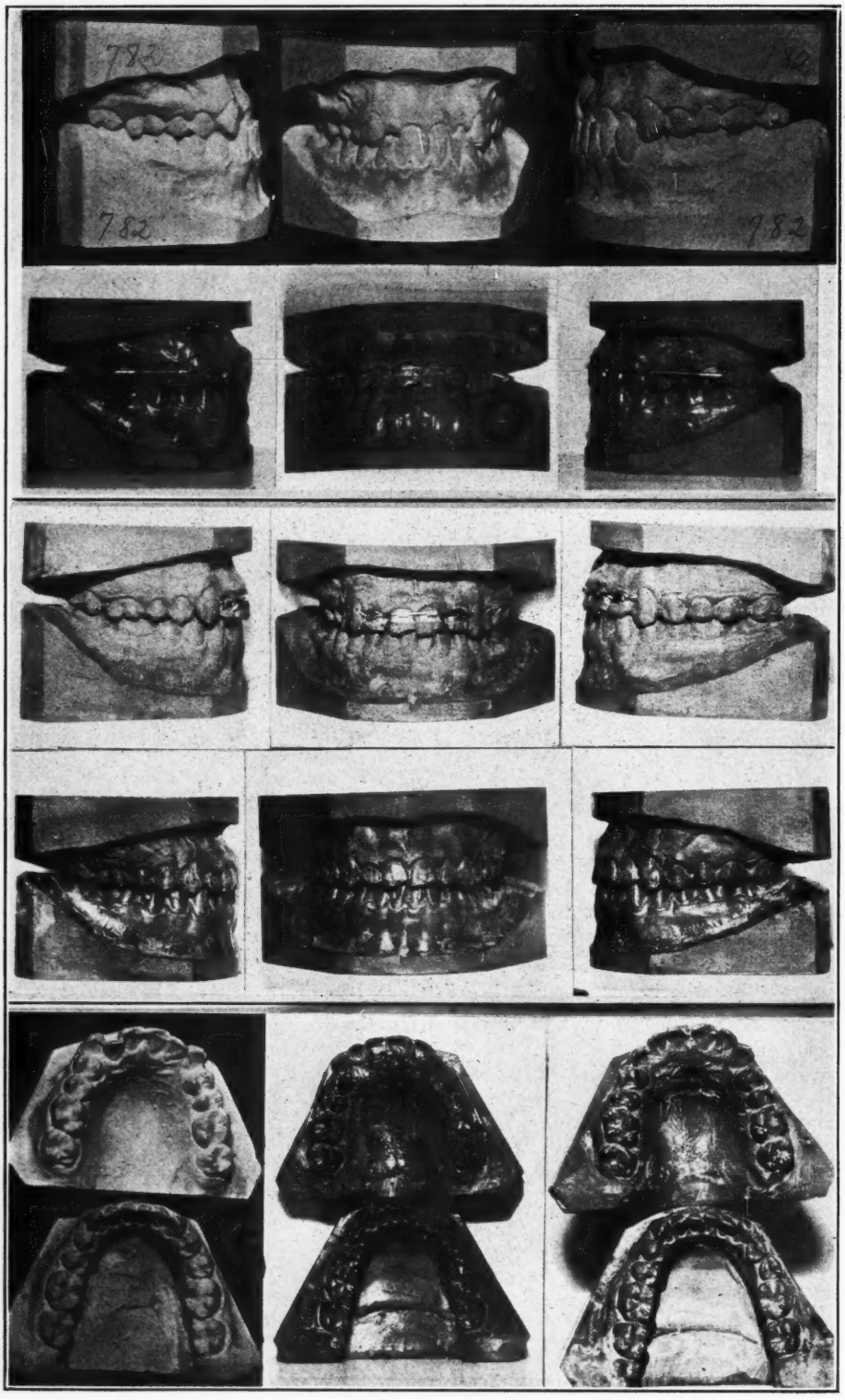

Fig. 31.

Fig. 32.

Fig. 33.

on the lingual with spurs resting against the mesial surface of the first premolar. No appliance was used on the mandibular teeth. I depended upon the lingual arch for anchorage. The mandibular models show results after six months' treatment, without any removal of the appliance. The lock upon the right lateral incisor was taken off once, a slight crimp in the twin wires was straightened out with a flat-nosed plier and the lock reset. This was all.

Since the boy was going away for the summer, all the appliances were removed, the teeth cleaned and the four anterior bands recemented. Iridioplatinum wire of 0.020 inch was rolled flat then locked to the teeth, as shown in Fig. 32 (upper models), the ends resting against the canines. The appliance was put on in this manner to permit the molars and premolars to drift forward, as they were slightly displaced distally. The lower models show the case when the boy returned in the fall. Now he is wearing a Hawley retainer on the maxillary arch at night. The wire clasp is around the canines instead of the premolars. Fig. 33 is a lingual view of the case. It shows the teeth at the beginning of treatment, at the end of six months, and the condition since the wearing of the Hawley retainer.

I offer the following summary of the advantages of the twin wire automatic appliance:

1. Simplicity in construction and operation. All the skill needed is in bending the twin wires into a normal arch form and locking to the teeth.
2. The teeth are moved automatically to normal arch form.
3. We automatically obtain root as well as crown movement.
4. Teeth are moved rapidly, without discomfort and with no injury to tissues.
5. It is very easy to keep clean.
6. Despite its fragile appearance, it is strong and is seldom broken by children.
7. It continues to work over a long period of time. Often upon removal after three or four months, I have found it still exerting pressure.
8. It is very neat looking.
9. The pressure, while light, is constant and produces physiologic tooth movement.
10. The operator has complete control of the force.

DISCUSSION

Dr. E. N. Bach, Toledo, Ohio.—Dr. Johnson is to be commended on the presentation of his subject, and for being, I believe, the first orthodontist to employ successfully wires of stainless steel or the chrome alloys in treatment of malocclusion. His presentation comes at a time when economic conditions favor appliances of this composition.

Dr. Johnson's paper and slides are so clear, the appliances and models so beautifully illustrated, that his whole subject becomes quite self-explanatory.

Dr. Johnson obtains practically all of the desired tooth movements with his appliance, such as rotations and bodily movements. These are done in a very gentle but positive manner. His originality in measuring pressures of springs is unique.

The question may be raised: why does he prefer the two round wires over a single square or rectangular wire, which would accurately fit the attachments on the band? Does he believe a more definite root movement could be obtained from the last mentioned wire?

So far in this brief discussion, the merits of Dr. Johnson's appliances have been brought out. I know of no appliance which is perfect. In my use of the twin wire automatic appliance, I have met with two difficulties: one, in which one or both of the wires breaks in the region of the hock; the other, in which the female part loosens and slips off. Extra clamping of this piece fails to hold it in place. I wonder whether Dr. Johnson has been confronted with this difficulty and if so, how it was overcome.

(Blackboard drawing.) Since reading this paper, I noticed in one of the illustrations that Dr. Johnson had the central incisor in a region like this, and the other central incisor in this region, and he brought one wire here and one wire bent up into here. I wonder what becomes of the wire which is not bent. There must be some giving of the wire some place inasmuch as it could not slide in the tube.

Dr. Hugh G. Tanzey, Kansas City, Mo.—I did not get to hear Dr. Johnson's paper, but I would be pleased to report that we are experimenting with one particular case that I thought was advisable, and it is working very nicely with an adult case where maxillary incisors are tipping forward and are spaced. I might add further that I expected this young lady would object to the appearance of this appliance, on account of there being so many bands, and I thought the lock was a little bit clumsy. There has been positively no objection on her part either to the appearance or to the comfort of this lock, and her friends have not criticized her.

Dr. E. N. Bach, Toledo, Ohio.—I failed to mention that, too. I have had the same success in a case or two where I have used them. It is very pleasing in result.

Dr. Percy N. Williams, Tucson, Ariz.—It has been remarked that a molar can be moved distally. At least, I got the impression that could be done with intermaxillary anchorage within the maxillary jaw. I should like to ask Dr. Johnson how he knows that maxillary molar can be moved distally by intermaxillary anchorage. It seems to me there is no force within the maxillary jaw that can move a molar distally, and certainly there is no way to measure the distal movement of that molar without going to external points on the skull.

Dr. J. E. Johnson.—I believe in my paper I mentioned about breakage of the twin wires, and the causes of same. In some mouths the stainless steel tends to corrode, and then we have the nervous child, who is continually picking at the appliances. This moving up and down seems to cause the wire to crystallize, which results in breakage. I believe these two things are the principal causes of broken appliances, and I do not find that I have any more breakage with the steel wires than with lingual appliances.

The illustration which I showed that Dr. Bach mentioned, was exaggerated to some extent to bring it out more clearly. Naturally these two wires are the same length; so when one of the wires is drawn up and seated in the lock, it would not be stretched as much as the drawing shows. I use this method very little. I prefer the one I showed in the illustration that was used to elongate the canine. As you remember I ran a 0.010 inch wire through the lock and ligated it to the twin wire arch.

I have never had any trouble with the female locks coming off. Some men have had that trouble, but I think it was because they did not follow the correct technic in seating them, which briefly is as follows: The pliers which is used to seat the lock is made with a stop, so that when you squeeze the pliers together it compresses the lock slightly, which makes it fit more snugly. The later locks are made to fit more accurately, and have a little catch on them that prevents them from being dislodged.

As Dr. Tanzey mentioned, the lock is ⅛ inch long, or rather the anterior band is made with a lock ⅛ inch long brazed to it. I have found that it is much easier to tip the apices of the teeth with this length lock than with a shorter one. However, if one prefers a short lock, it is very easy to cut it off to the length desired.

[Dr. Johnson then illustrated on the blackboard why it is easier to tip a tooth with a long lock rather than a short one.]

As Dr. Tanzey has said, the patients do not seem to object to them, so I very seldom shorten them.

Dr. Tanzey.—Why do you not make your pliers right angles? It would work a lot easier.

Dr. Johnson.—You mean bring it out like that?

Dr. Tanzey.—Yes.

Dr. Johnson.—Pliers made like that would cost four or five times more than straight pliers.

Dr. Tanzey.—It would be worth that much more.

Dr. Johnson.—I do not believe the right angled pliers would be any better than the straight pliers. I do not have any trouble with the straight pliers.

I believe it is as easy to move a molar distally as it is to obtain any other tooth movement. None of these models here will show it, but I am now pouring my models in an articulator. It is on the principle of the Simon method. I pour the models in an articulator which has the eye and ear points located on it. I can show model after model in which molars have been moved distally, and can measure the movement accurately down to one hundredth of an inch.

Briefly, this is the method I use to move a molar distally: a coil spring which exerts four ounces of pressure is placed over the end tube. I never exert more than four ounces on the molar, for that is sufficient to move it distally. Then to prevent the anterior teeth from coming forward, intermaxillary rubbers are used, which exert five or six ounces of pressure.

Dr. Williams.—Are you absolutely certain the anterior teeth stay stationary?

Dr. Johnson.—Sure.

THE CRISIS IN ORTHODONTIA*

Part I

3. Critical Review of the Publications on Orthodontia by B. Gottlieb, B. Orban, A. M. Schwarz and J. A. Marshall†

Albin Oppenheim, Vienna, Austria

(Continued from page 769, August)

In the first part of this chapter the different points of view of Gottlieb, Orban, and Schwarz in regard to some actual orthodontic questions will be considered critically. In doing so, it will often be impossible to distinguish between these authors, for in their works they quote each other, and all three arrive at the same conclusions. My standpoint in regard to their conclusions and deductions is, therefore, identical for each author. As to Gottlieb and Orban, only their conclusions for the practice of orthodontia, based on experiments on dogs, will be reviewed.[1]

Caps were cemented on the first molars of dogs, thus producing a considerable open-bite in the anterior teeth. The molars wearing caps were forced out of place by the occlusal force until the anterior teeth and the posterior teeth on the opposite side came into normal occlusal contact again. The changes in bone and teeth produced by these strong occlusal forces are the basis for Gottlieb and Orban's conclusions. Some findings on incisors which were moved orthodontically by strong silk ligatures and some additional material of monkeys and man are also given in the book.

If we claim the right to apply to man conclusions drawn from experimental animals and to lay down rules for a procedure with patients, we must show that the first requisite for such a procedure was followed: *that the arrangement and conditions of the experiment corresponded completely with the mode of procedure with patients.*

This was clearly expressed by Sandstedt[2] (1905, p. 247): "If the results obtained by experiments are to be considered *at all* conclusive, these experiments must be performed under conditions which will correspond as nearly as possible to those present in man during orthodontic procedure. . . . Besides, mechanical appliances must be used which are like those generally used in orthodontic practice."

Besides Sandstedt, many others, including Breitner, Herzberg, and Kronfeld, express their opinion on this subject with almost the same words.

Gottlieb and Orban neither consider nor apply this fundamental postulate for every experiment. They are of the opinion that "if a tooth is moved by

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†Translated in abbreviated form from *Ztschr. f. Stomat.*, supplement to No. 22, November, 1933, published by Urban & Schwarzenberg, Vienna and Berlin.

strong forces which are applied to the crown in one point, then on the cross-section of the root can be found the biologic effects of these strong forces as well as of the most gentle ones'' and that (in applying force to the anterior teeth) ''the lateral incisors are touched only slightly and not directly influenced by the pressure of the arch, viz., they are influenced only by a component of this force''; therefore, in the histologic slide these teeth would show the effect of a gentle force.

If these authors claim from their histologic findings in animals, and occasionally in man, that ''henceforth only gentle continuous forces should be considered in the practice of orthodontia,'' this conclusion is not justified by their material, for their results in animal as well as in man are obtained by very strong occlusal forces, forces that are not used in any orthodontic procedure.

Had Gottlieb and Orban confined themselves to the main reason for conducting their experiments, that is, the investigation of the loosening of teeth (p. 218), nothing could be said against their work; for in investigating this question, they followed the first requisite for such an experiment: the conditions in the experiment were comparable to those in man. But if very strong forces of entirely unknown intensity are applied, how can the results obtained from such a procedure be used to determine the necessity for using *gentle continuous forces* in the practice of orthodontia? Gentle forces were never applied in the whole experiment and because of the mode of procedure never could have been produced. The masticatory force is a *purely intermittent* one and because of its intensity not comparable to any force used in modern orthodontia; if, therefore, Gottlieb and Orban had claimed that hereafter only gentle *intermittent* forces are permitted in the practice of orthodontia, at least the type of force would have been the same, although the histologic findings of *very strong* intermittent forces would by no means justify the claim that henceforth only the weakest intermittent forces are admitted.

It is self-explanatory that Sandstedt, who also worked with strongest intermittent forces (screws) and whose findings are considered authoritative by Gottlieb and Orban, in spite of the powerful influence on the teeth sometimes found slight changes, ''a state of relative rest'' (p. 157): he usually observed this condition of relative rest near the middle of the root, because a root which tipped by strong forces and thereby locked at the alveolar margin and near the apex, cannot press against the alveolar wall near the middle of the root; here must be ''the state of relative rest.'' And even if there are fewer changes and less destruction in several other places in addition to the middle of the root, they are not the result of a slight direct force, but are to be considered as the remote action of strong forces, the same as in the experiments of Gottlieb and Orban. Sandstedt, however, does not draw any conclusions from these pictures which show fewer changes.

The findings of Sandstedt were fully verified by Gottlieb and Orban; it could not be otherwise, for in both experiments the same kind of forces was used, strongest intermittent forces (by Sandstedt the screw, tightened every

day; by Gottlieb and Orban the intermittent forces of mastication). Schwarz,[3] however, interprets the pictures of Sandstedt as the result of continuous forces (this will be discussed later on).

In summarizing, I cannot admit (1) that the changes produced by the remote action of strong intermittent forces are identical to the changes produced by the direct action of gentle continuous forces; (2) that the changes produced by strong continuous forces (Sandstedt as interpreted by Schwarz) may be coordinated with and considered equivalent to the changes produced by strong intermittent forces (masticatory force of Gottlieb and Orban); and (3) the right of Gottlieb, Orban, and Schwarz to draw from their own findings as well as from those of Sandstedt this conclusion for the practice of

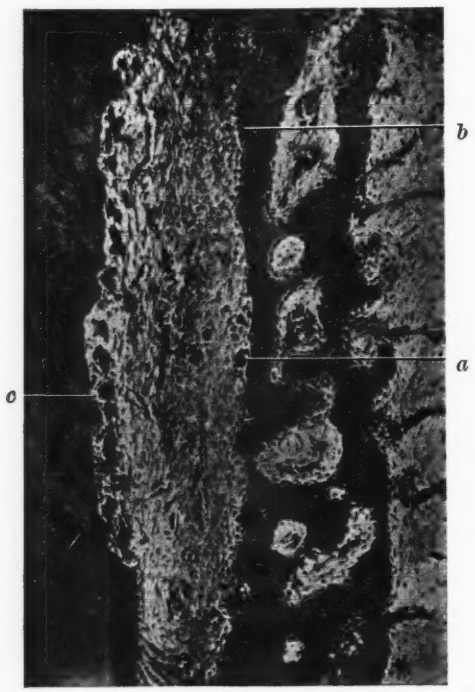

Fig. 1.—Gottlieb and Orban's Fig. 194 (human tooth). The old bone was entirely resorbed and replaced by osteophytes which are arranged in the characteristic way. They represent the new alveolar wall. The tooth shows signs of acute resorption (bone resorption, *a;* new formation of bone, *b;* osteoclasts, *c*); bone surface nearly intact.

orthodontia, "that only the most gentle and continuous forces are admissible," because this statement is not substantiated by their histologic findings.

Summarizing at the end of their book, Gottlieb and Orban say (p. 225): "In a human denture we have seen a case (Fig. 1) in which after the resorption of the old alveolar bone the newly formed bone deposited on the outer surface formed the new alveolar inner wall. But although the bone is only slightly resorbed, there is very pronounced resorption on the tooth surface. This condition is due to the fact that the newly built bone probably has a greater resistance to resorption by pressure. *In orthodontic procedures, therefore, one ought not too often allow an interruption of the force.* During each

pause new bone (osteoid) is formed in the area of pressure and when active movement is continued, this newly formed bone must be resorbed. A continuous gentle force, therefore, appears to be the most suitable one."

Gottlieb and Orban show this single case (Fig. 1) of inverted relation of resorption on bone and tooth and draw from it the deduction quoted; on the other hand, we find several cases (Gottlieb and Orban, Figs. 39, 58, and 175) in which the teeth, after all the old bone has disappeared, press only against newly formed osteophytic apposition of bone and cause its resorption, without exhibiting the slightest indication of an injured cementum. But from these three and other similar cases, Gottlieb and Orban do not draw any deductions which might allay the frequently expressed concern about the newly formed osteoid bone.

On the basis of the findings in their material, they recommend a treatment of slight continuous force without any interruptions, and summarize in the statement (p. 220), "that in juvenile dentures, forces of average intensity, such as are commonly used in orthodontia, cause only bone resorption, no tooth resorption. They must, therefore, be qualified as entirely harmless. After the discontinuation of the force the restoration of an intact alveolus with an uninjured tooth surface is to be expected *with absolute certainty.*" These authors could not arrive at this conclusion except by theorizing.

Was it necessary to perform these many experiments with forces not commonly used in orthodontia in order to arrive at this conclusion? Was it necessary to perform these experiments which resulted in very extensive undermining and resorption of cementum, as well as ossification of the periodontal membrane? These pathologic conditions could be produced only by forces which are not commonly applied in orthodontia.

Gottlieb and Orban lacking any clinical experience in orthodontia neither had nor have the ability and judgment to control and to verify their conclusions for the practice of orthodontia which were drawn from their experiments on animals.

By recommending methods which were neither tried nor proved, Gottlieb and Orban violate a fundamental postulate, generally acknowledged and considered as self-evident in scientific research, the postulate expressed by Lundström[4] years ago: "Before laying down therapeutic rules we ought first of all to prove their reliability."

Because of this evident lack of proof of the reliability of the recommended therapeutic rules, I cannot from the clinical standpoint accept Gottlieb and Orban's claim for the use of continuous forces without interruption, especially not in the manner in which they are used by Schwarz, as already mentioned (INTERNATIONAL JOURNAL OF ORTHODONTIA, March, 1934, p. 254).

No matter how much scientific research may be valued, it cannot be considered as the final authority on the practical work of specialists; at least the same evaluation must be given to the clinical experience. The conclusions gained by theorizing or by experiments must first be tested in practice, with full appreciation of the difficulties that are encountered even by the experi-

enced practitioner. No experiments, no theoretical deductions, offered in ever so dogmatic a fashion, can counterbalance or refute practical experience. Histologic knowledge, however well founded it may be, does by no means entitle one to analyze critically the efficiency of an orthodontic appliance; to do so practical experience of long standing gained by intensive clinical work is required. After all, orthodontia owes its high degree of development mainly to the knowledge gained by clinical experience.

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(*To be continued*)

ACCURATE AND ORIGINAL METHOD OF DETERMINING THE SAGITTAL PLANE*

PERCY NORMAN WILLIAMS, D.D.S., TUCSON, ARIZONA

THIS clinic demonstrates an accurate and original method of determining the sagittal plane.

Fig. 1 shows the odontograph, an instrument used for transferring the original arrangement of the arches from the plaster casts to a three-by-five-inch

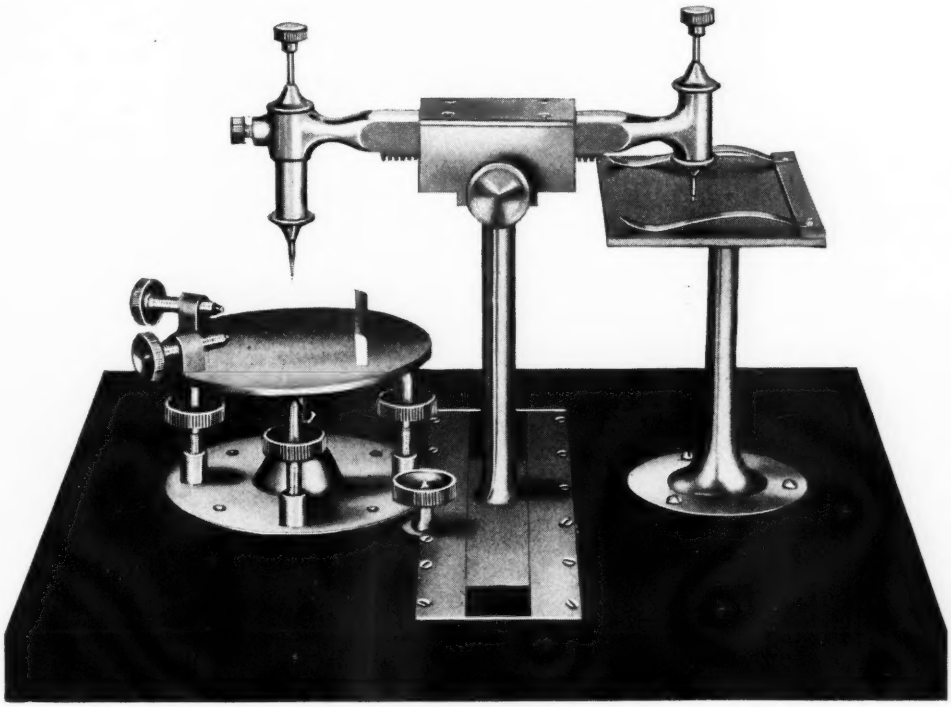

Fig. 1.

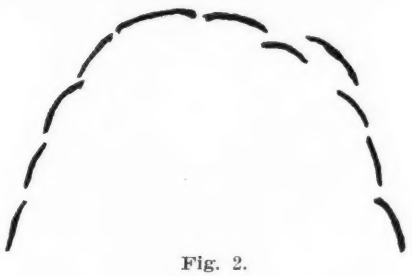

Fig. 2.

card. Beginning at the buccal groove of the maxillary right molar, the buccal planes and the incisal edges are recorded as shown in Fig. 2. The card and the casts are now laid aside, and the work is transferred to the patient.

*Clinic presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, Okla., November 8-10, 1933.

Fig. 3.

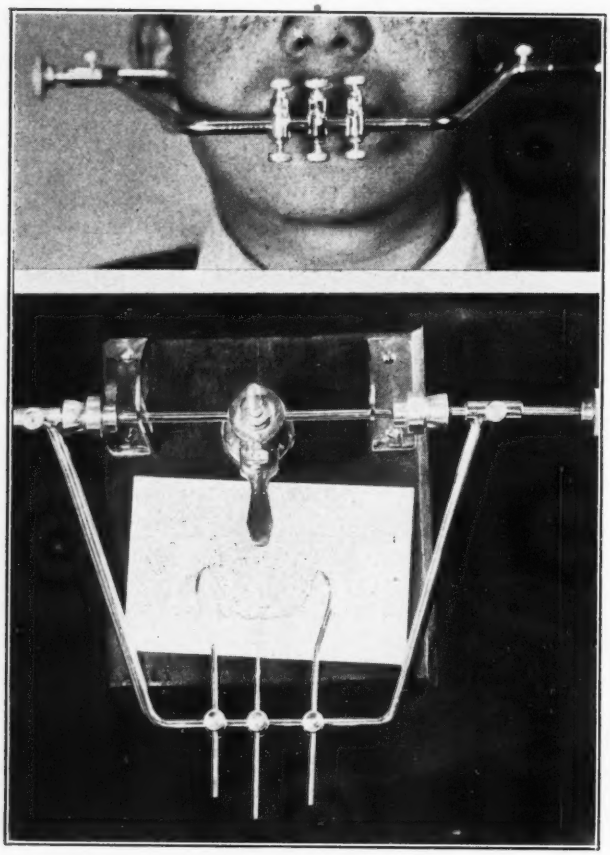

Fig. 4.

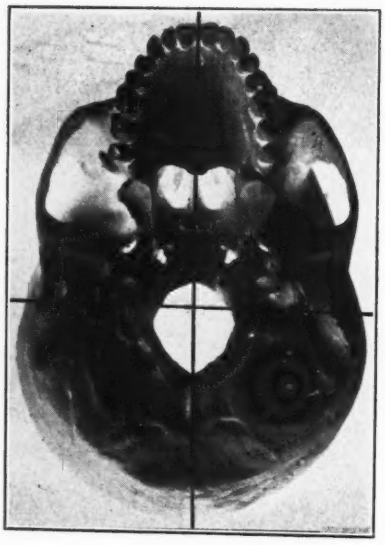

Fig. 5.

Fig. 3 shows the symmetroscope. It is designed to fit into the ears. The rods with the cone-shaped points are adjustable. On the front part of the instrument are three pointers which are adjustable back and forth and laterally. The instrument is clamped to the head, the cone-shaped pointers being pressed firmly to the ears. The assistant now supports the instrument while the operator adjusts the points to record the position of the buccal grooves of the maxillary molars and the median line in the region of the central incisors. The pointers are firmly clamped and the instrument is removed.

It is now placed in the stand, Fig. 4. The record card upon which is the arrangement of the teeth transferred by the odontograph is now placed on the table of the symmetroscope, and the points indicating the buccal grooves of the maxillary molars of the record card are brought into juxtaposition with the points on the symmetroscope, which were obtained directly from the patient. The point indicating the median line of the face is now projected backward at right angles to a line drawn between the cone-shaped points, which indicate the ear-to-ear line, Fig. 5.

This is the true median line of the maxillary arch. If this line were projected perpendicularly, it would indicate the sagittal plane.

THE PRACTICAL APPLICATION OF STAINLESS STEEL IN THE CONSTRUCTION OF FIXED ORTHODONTIC APPLIANCES*

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A COMPLETE alteration in the basic material used in the construction of fixed orthodontic appliances can only take place after the new material has been tried in actual practice by a number of workers whose technic varies, and after it has been demonstrated that the new material has definite advantages over that which it is proposed to displace, and that when it has disadvantages, these can be overcome.

I have now employed stainless steel exclusively in my practice for the last year in making new appliances, and propose in this paper first to discuss the relative advantages of stainless steel and gold alloys, then briefly to describe the theory and practice of electric welding as applied to stainless steel in the preparation of orthodontic appliances, and finally to explain in some detail the appliances which I use in my work and the technic of their construction. Stainless steel was invented by an Englishman, Brearly of Sheffield, in 1913, and there are now several proprietary brands, varying slightly in their chromium-nickel content. These brands may be divided into two distinct types, the austenitic and the martensitic. The former is stainless at any degree of hardness, can only be hardened by working in the cold state, and is softened by heating or by heating and quenching. It is this type which is employed in orthodontic work. (The martensitic alloys, which are used, for instance, for making cutlery, are stainless only in the tempered state, and can be tempered by heat treatment.) The percentage composition of three of the chief austenitic brands is as follows:

Firth's "Staybrite." Chromium 18 per cent, nickel 8 per cent, carbon 0.1 per cent.

Brown Baily's "Anka." Chromium 15-16 per cent, nickel 10-11 per cent.

Krupps' "Wipla" V.2.a. Chromium 20 per cent, nickel 7 per cent.

We now come to a consideration of the comparative advantages and disadvantages of stainless steel and gold alloys. The first and most obvious advantage of the former is the enormously reduced cost. A major item in the cost of running an orthodontic practice disappears for all practical purposes. One pound of steel wire will cost from 4*s.* 6*d.* to 8*s.* 6*d.*, according to the diameter, while a similar weight of gold will cost about £145. Next we find that stainless steel has greater tensile strength and greater toughness than gold, both these factors being of prime importance in view of the desirability of reducing to a minimum the size of the appliance in the patient's mouth. It is also found that stainless steel appliances remain untarnished and keep clean in all cases,

*Transactions of British Society for the Study of Orthodontics, 1933.

while those made of gold alloys tarnish in many mouths and are liable to collect débris. The disadvantages of stainless steel for orthodontic work lie entirely in the difficulty of working the material by methods employed with gold platinum alloys. With the latter, joints can be made with hard and nontarnishing solder, without undue loss of temper, while by the use of heat, appliances can be adapted very exactly to models, and the complete appliances can be tempered by heat treatment. The low softening temperature of stainless steel, on the other hand, prohibits the use of any but a low fusing solder, such as that known as "silver" solder, because the use of the flame in this process causes oxidization which should be removed; this is a tedious operation and, in the case of complicated appliances, difficult. Again, temper once lost by heat can

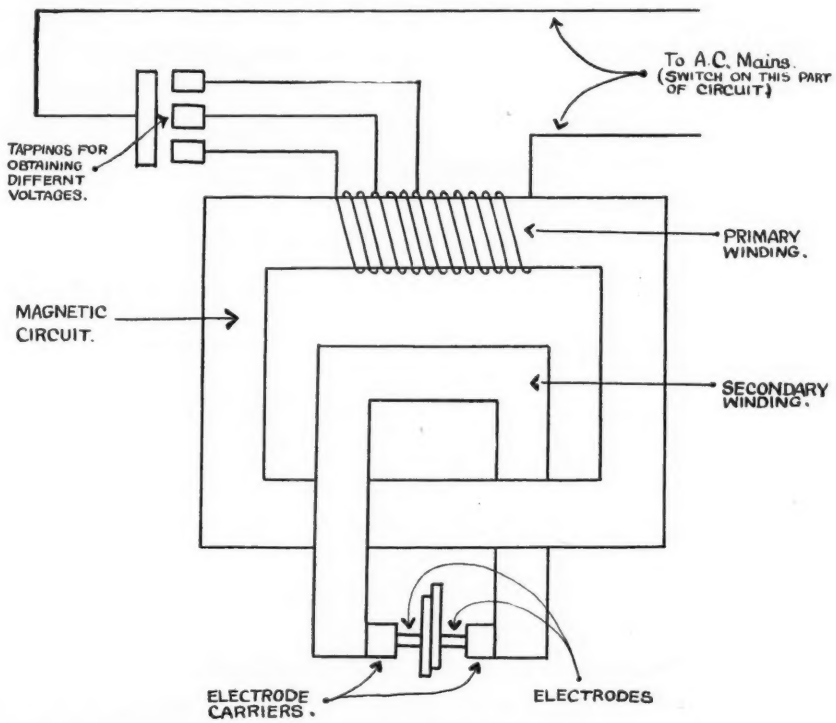

Fig. 1.—Diagram illustrating electric circuits of welding apparatus. Adapted from Wilson's "Electric Welding."

only be restored by cold working. Adaptation to models by the use of heat is inadmissible, so that great exactness in bending up appliances is necessary. Finally, the hardness of the material, otherwise an advantage, makes it very severe on tools, and particularly on cutting tools.

From this comparison of the virtues and vices of stainless steel and gold platinum alloys, it appears that if a really satisfactory process for uniting steel parts were available, that material would have outstanding advantages, and I am setting before you an account of what seems to me, after a year's experience, such a process—electric welding.

In general terms, welding is "the uniting or joining together of two pieces of metal when raised to a great heat," and in the form of electric welding here

described that heat is generated by the resistance of the parts to be joined to the passage of an electric current; hence the name, resistance welding.

As many points in the technic are governed by the electrical conditions, it is useful to understand something of the theory of the process. It is simply that the passage of a current through any circuit generates heat, and that, since in any part of the circuit the heat varies as the square of the current multiplied by the resistance, the greatest heat will be at the point of greatest resistance. Keeping this in mind, we can easily understand the practical application of it in the apparatus.

Fig. 1.—The first requirement is a heavy current, that is, a current of high amperage, and to get this we have in the welder a static transformer, into the primary coils of which the current of high voltage (100 volts to 250 volts A.C.) which is ordinarily available is fed, with the result that a low voltage current of high amperage is induced in the secondary circuit. For our purpose this voltage will be two volts or less in the British machine and up to four volts in the Belgian machine, and the amperage about 500-750. With the primary circuit, our only concern is that it requires to be wound to suit the voltage of

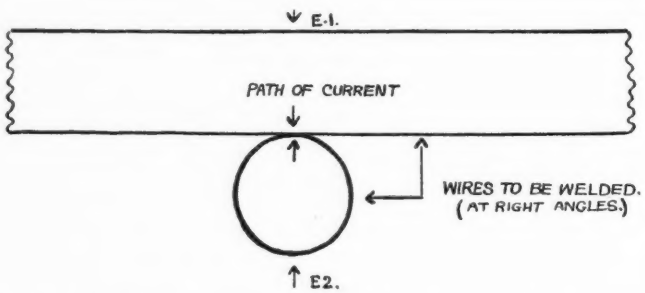

Fig. 2.—Diagram showing path of welding current between two pieces of wire to be welded.

the user's supply, and that a variable tapping provides a convenient control of the welding voltage.

Conditions in the secondary circuit, in which the welding is done, are more important to examine. It consists of three parts—the secondary winding of the transformer, the electrodes and their carriers, and the pieces to be welded. Keeping in mind that the heat will be highest at the part of the circuit where resistance is highest, it is obvious that we require that the resistance in the first two of these should be very low compared to that in the third, and in a properly designed welder this is the case. The function of the electrodes is to provide a convenient means of bringing the current to the right point for passing through the material to be welded.

Considering now what makes the resistance high in the third part of the circuit, we find that two chief factors operate, the comparatively high natural resistance (low conductivity) of stainless steel, and the smallness of the path open to the current.

In Fig. 2, if the two wires are arranged in an electric circuit in such a way that current must pass from one to the other, it is obvious that its path, the point where they touch, is very minute, and so offers an extremely high resistance

compared to the thick electrodes of high conductivity material. This means that the heat at that point will be correspondingly high, with the result that the surfaces in contact will fuse, and if there is pressure on them, will unite. There is an additional factor here helping to concentrate the heat at the one point, namely that resistance is highest at the surface of the material, due to oxidization.

We have to take account of three other factors influencing conditions in the welding area. First, conduction of heat. If current continues to flow through the wires, the heat will spread from the contact points, resulting in

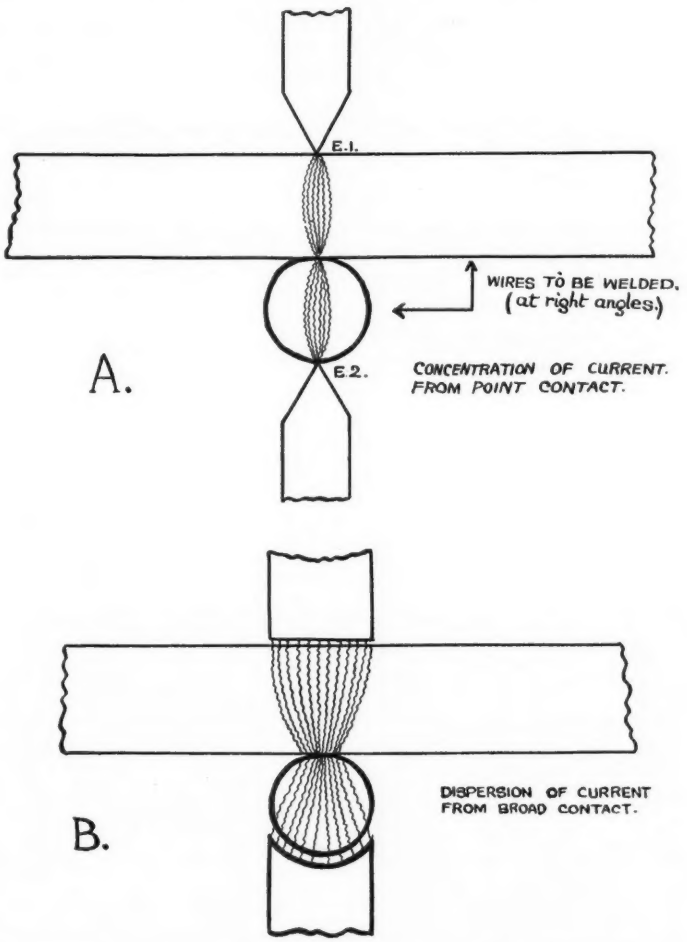

Fig. 3.—Diagram showing path of current between (*A*) pointed electrodes, (*B*) broad contact electrodes.

softening and eventually deformation of the wires. Obviously, then, current should only flow for sufficient time to allow the surfaces to fuse, but that time will depend on the weight of current flowing, so we get the rule *to use the maximum current for the minimum time.* In practice, there is a limit to the quickness even of an automatic switch, but the rule should be observed as far as that limit will permit.

Second, it has been stated above that pressure completes the weld, but to avoid deformation of the heated metal that pressure should be kept to a mini-

mum. (In the British Insulated Cables Ltd. welder the amount of pressure is exactly regulatable.) Pressure also requires to be maintained until the weld has cooled, in practice a very short time.

The third factor in the welding area is that the manner in which the electrodes make contact with the wires has a considerable influence on the nature of the weld. The place to apply the electrodes is at E1, E2, Fig. 2, immediately opposite the contact points, as not only can we then apply pressure through the electrodes, but we have the current passing through and so heating, the minimum of high resistance material. In addition, the area of contact is important.

Fig. 3 *A* and *B* show the paths of current flowing through a joint from pointed and broad electrodes respectively. With pointed electrodes the current

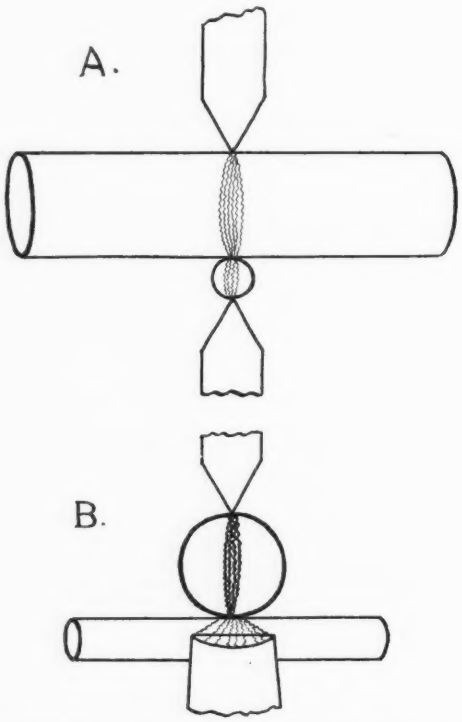

Fig. 4.—Diagram showing the effect of (*A*) two pointed electrodes on weld between wire of widely differing section, (*B*) one pointed electrode in contact with thick wire and broad-grooved electrode in contact with thin wire.

is more concentrated, so that for the same current and time we get a greater heat and a better weld; and if we were always welding parts of equal section we would always use pointed electrodes, the actual shape of the point being largely governed by the mechanical strength of the electrode material. It will be noted that where contact occurs between electrodes and parts to be welded, conditions of high resistance occur, so that there is some heating of the surface, but it is less than between the two parts owing to the higher conductivity, both of electricity and heat, of the electrodes. To keep this heating to a minimum it is necessary that the electrode points should be free from oxidization. But the different conditions existing when two parts of widely differing sections are to be welded require some modification of this contact form. In Fig. 4 *A* an

example of this sort is shown. The area of a thin wire fuse in making the weld is in any case proportionally greater than in a thick wire; also for a given current welding temperature will be reached in a shorter time, so that by the time the thicker wire has reached welding temperature conducted heat will have

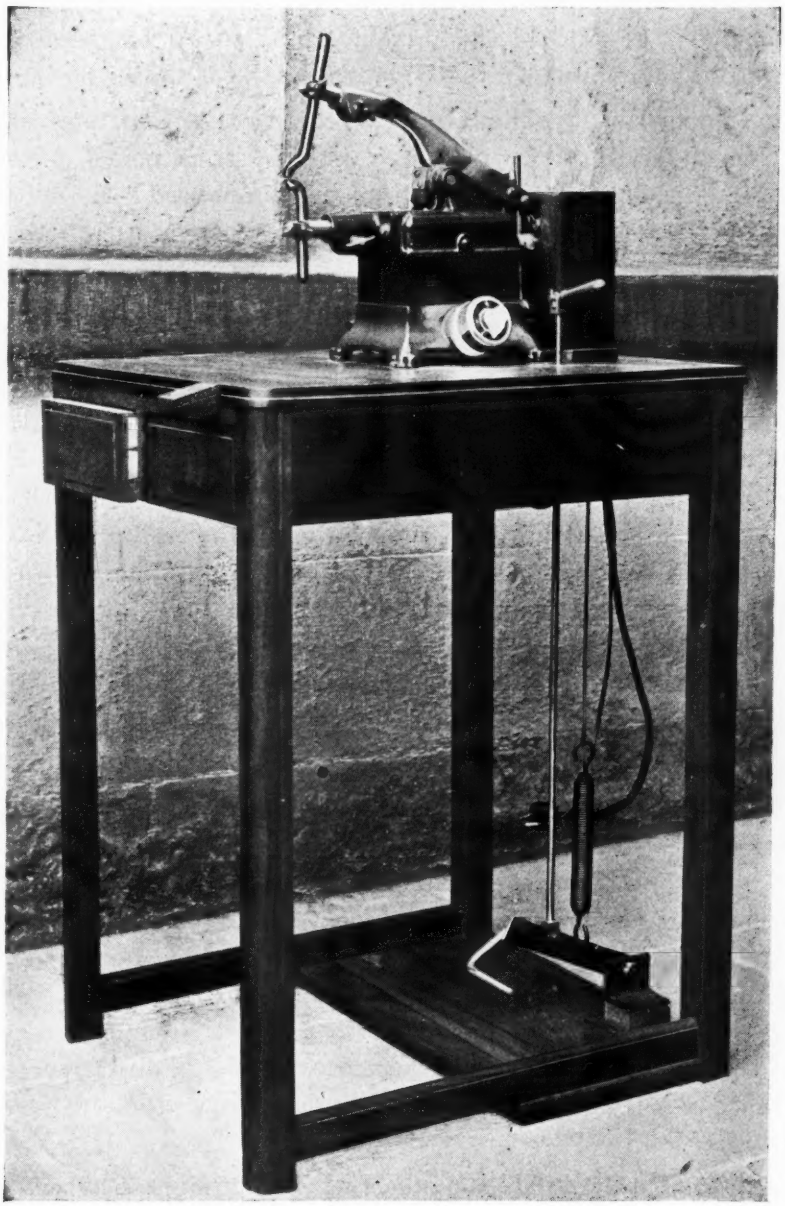

Fig. 5.—Welder supplied by the British Insulated Cables Ltd. Pedal closes electrodes and operates trip switch.

softened the whole of the thin wire, allowing it to deform under the pressure. But if we apply to the thin wire an electrode that makes with it a larger area of contact (Fig. 4 *B*), the current will be more dispersed, the resistance less, and the time taken to reach welding temperature consequently equalized with that of the thicker wire.

These are the extreme conditions, and the contact areas required for other kinds of joint are readily deducible from them.

It may be useful to point out that it is for joining two relatively thin parts that the voltage control is required, and for the reason that the dwell of the switch is so long, even at its minimum, to fuse excessively the materials with the full current. The reduced current requires a longer time to achieve welding temperature, and so brings that time within the compass of the switch.

It is to be noted that the input current for a welding apparatus of ordinary type must be alternating. To use direct current from mains a convertor is necessary. Batteries of the nickel iron type have been used for some apparatus. I have no experience with these. From the theoretical aspect, battery operation appears to suffer from lack of amperage, unless a very large and expensive battery is used.

Some practical features in the design of the welding apparatus are of importance. The controls should be such that the hands are left free. In the British Insulated Cables Ltd. welder this is achieved by the use of one pedal, which first closes the electrodes on the parts to be welded, then, on further depression, operates the switch. The two welders of which I have had experience are (1) that designed by Charlier of Belgium (and supplied by the Produits Dentaires "Belgica," Brussels); (2) that supplied by the British Insulated Cables Ltd., Prescott, Liverpool.

The Belgian machine that was shown at the Second International Orthodontic Congress in London does not supply sufficient current for all the purposes that I required. The latest model is, I believe, more powerful. My machine is worked by two pedals. One of these pressed acts against a spring and opens the electrodes; the second pedal works a trip or trigger switch. The whole outfit is complete with table.

Fig. 5.—The British machine is very compact but has to be fitted on to a table or bench. It has only one pedal. In this case the electrodes are apart and are brought together by pressing the pedal a certain distance. As the pedal is pressed further, it brings into action the trip switch. With further pressure of the pedal the switch goes off, but the pressure between the electrodes remains. The electrodes show a distinct improvement over the plain copper electrodes. They are made of some copper alloy which stands up five times better than does the plain copper.

The technic that I employ is probably not original, but a modification of that used by many orthodontists. The amount of current used in each operation will be stated in brackets as one of three strengths or speeds: (High), (Medium), (Low).

This portion of the paper will be under the following heads: (1) plain bands or rings; (2) arches or bows; (3) tubes, horizontal and vertical; (4) springs; (5) labial extensions from lingual arches; (6) hooks for intermaxillary elastics, on molar bands and arches; (7) materials used.

1. PLAIN BANDS OR RINGS

Many papers have been published on the making of plain orthodontic bands for molar teeth. They all recognize the difficulty of making a collar that will fit the cervical margin of a tooth, and they all describe their different methods of trying to overcome this difficulty. The stability of an appliance depends to a large extent on the fit of the molar bands. Not only, however, is the stability of the appliance at stake, but also the health of the gingival tissues. I shall

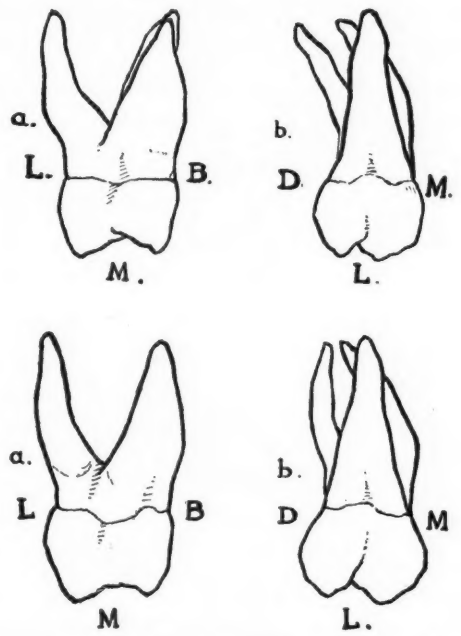

Fig. 6.—Drawing of two maxillary left first permanent molars, (*a*) viewed from medial aspect, (*b*) viewed from lingual aspect.

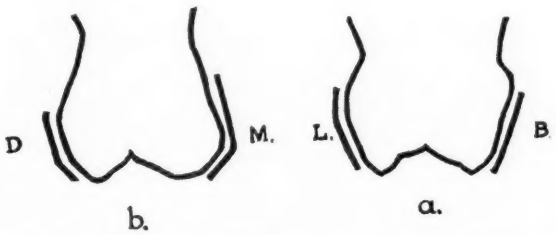

Fig. 7.—Diagrammatic drawing of maxillary left first permanent molar with outline of plain band, (*a*) viewed from the medial aspect, (b) viewed from the buccal or lingual aspect.

now describe my own technic. The procedure is slightly different in making bands for maxillary and mandibular first permanent molars owing to the difference in shape and inclination.

Fig. 6.—*The maxillary molar,* as viewed from the medial or distal aspect; the buccal and lingual surfaces are inclined upward and outward relative to the long axis from the coronal margin. The inclination on the buccal side ends about 1 mm. to 2 mm. crownward from the enamel cementum junction, while above this point the surface is inclined in the opposite direction. On the

lingual side the main inclination ends further away from the neck of the tooth and is more marked. Above this point the surface is inclined in the opposite direction. Viewed from this aspect, a collar, to get a grip of the tooth, would require to go slightly above the end of the main inclinations (Fig. 7 *a*).

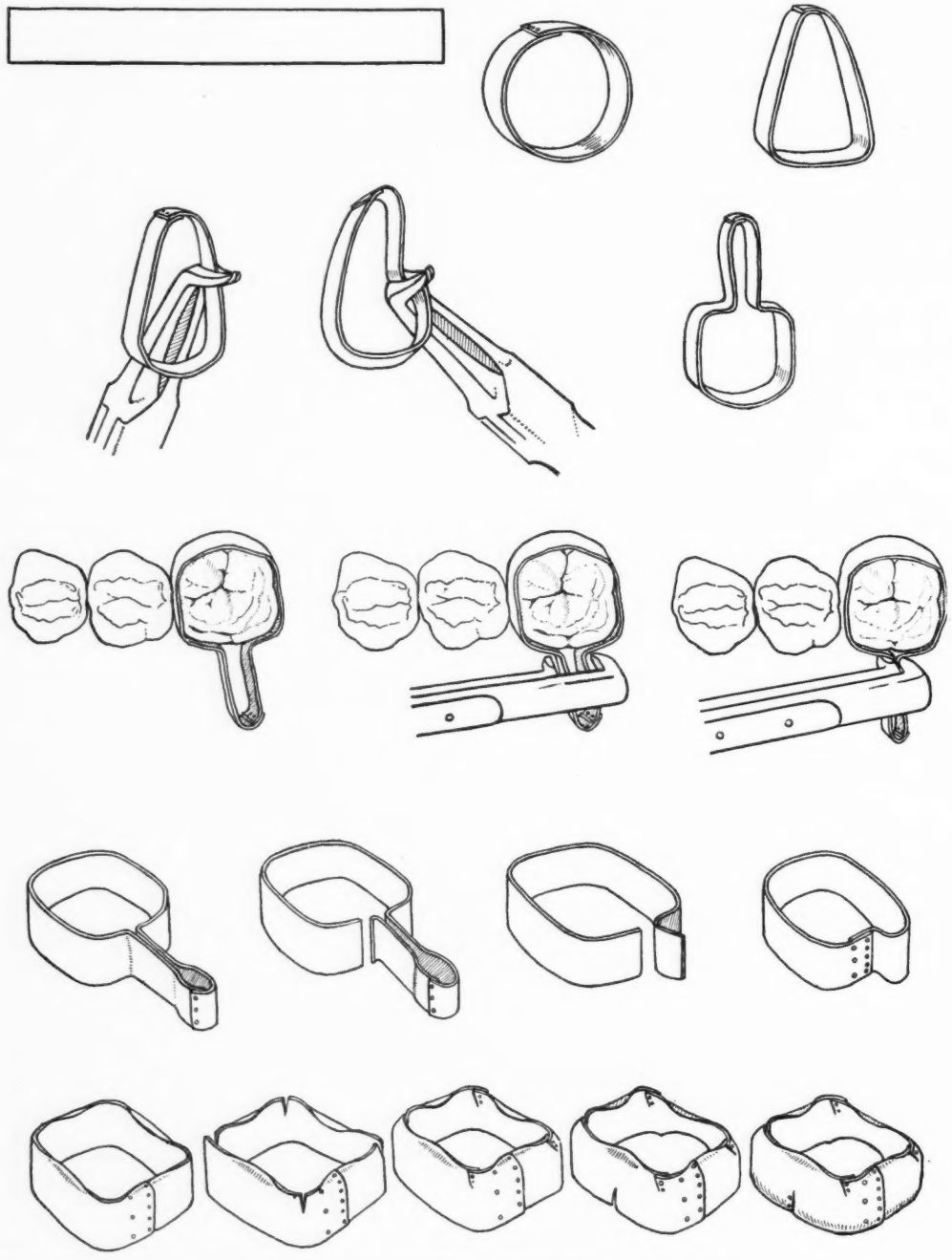

Fig. 8.—Stages of maxillary molar band construction.

Fig. 7.—The view of the medial and distal sides from either the buccal or the lingual aspect is quite different. The coronal quarter of the medial side is inclined upward and outward. Above this point it is flat for a short distance

and is then inclined in the opposite direction. On the distal side the coronal half is inclined upward and outward at about the same angle as the rootward inclination of the medial surface, these portions of each surface being nearly parallel to each other. Above the end of the inclination on the distal surface, i.e., above about halfway, the surface is inclined in the opposite direction. So here we have two surfaces each divided into two parts, the gingival inclination of one side being parallel to the coronal inclination of the other side. It is obvious from this that a band can only fit the whole of three inclinations.

Fig. 7 *b*.—We recognize this difficulty every day. The ring can be easily worked up on the medial side, but if the band is sufficiently tight we have great difficulty in getting anywhere nearly up on the distal side.

There are undoubtedly great variations in the form of the sides of maxillary molars. Thus one may meet with medial surfaces nearly vertical below the contact point, or distal surfaces less bulged than the average.

Fig 8.—The ends of a piece of band material, polished on one side, about 6 cm. long by 5 or 6 mm. wide, are joined together. The electrodes (*a* and *b*,

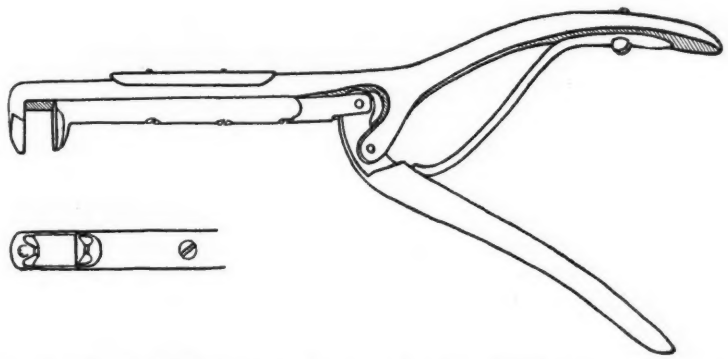

Fig. 9.—Band-forming pliers, blades working at right angles to shaft.

Fig. 24) used are two plain fine points about 2 mm. diameter at the points, the current used being (Low) and the switch being in operation for the shortest possible time. The loop is now shaped so that the part further from the joint is made approximately to fit the buccal surface of the tooth. The band is held in a pair of Pullen's band-forming pliers about 8 or 9 mm. from the distobuccal angle and is bent at right angles in order to form the distolingual angle, and at the same time it is bent at right angles in the opposite direction nearer the welded joint. A double bend in opposite directions is thus made at the one operation. The band is now turned over, and a similar procedure is done 8 or 9 mm. from the mediobuccal angle. The band is now in the form of a ring with two tails, like a pull-to joint. This ring is placed on the tooth in the required position and is squeezed with special band-forming pliers (Fig. 9), the blades of which work at right angles to the shaft. The ring is removed (Fig. 8). One tail is cut slightly ringward of the crease made by the pliers, and the other tail is cut off about 3 mm. tailward from the crease. The side cut close to the crease is lapped over the 3 mm. projection to the crease and welded. This cutting of the ring a little short of the crease makes the fit a little tighter. The squeezing

of the ring onto the tooth does get, to a large extent, the shape of the tooth. The band is now placed on the tooth, and with the help of a wooden tongue depressor and Pullen's band adaptor and round orange-wood sticks, it is driven up to the required position. If it has been made too tight, it can be enlarged with a Mershon's contouring pliers at the point where it is bearing, usually the distal surface, though at times the mediolingual surface. When pushed up to the proper position, the center of each of the four coronal margins is burnished in with a burnisher. The ring is removed and the four coronal corners are cut with scissors to a depth of about 1 mm. With S.S. White pliers No. 118, the cut corners are overlapped and then welded. A vertical cut about 1.5 mm. long is made with scissors at the center of the mediocervical margin. The distocervical margin is festooned. With S.S. White pliers No. 118, the cervical edge is bent inward, starting at the center of the buccal and lingual sides and

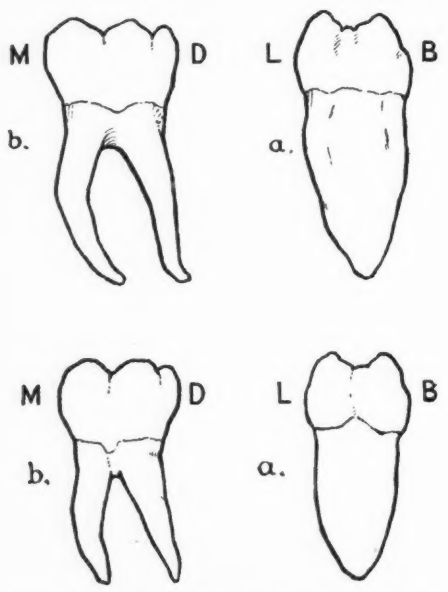

Fig. 10.—Drawing of two mandibular left first permanent molars, (*a*) viewed from medial aspect, (*b*) viewed from buccal aspect.

working to the cut on the medial side and along the festooned distal side. The overlapped cut on the medial side is welded. The projecting corners where the band has been cut, overlapped and welded should be flattened with contouring pliers. The band is again put on the tooth and gradually worked up to the required position. The coronal edge is burnished all round. If the distal coronal edge should overlap on to the occlusal surface, this overlap should be filed away with an oval file.

Fig. 10 *a*.—*The mandibular molar* presents quite a different shape to that of the maxillary molar. As viewed from the medial aspect, the buccal surface is sharply inclined downward and outward relative to the long axis from the coronal margin to about 2 mm. above the enamel cementum junction. Below this point it takes a reverse inclination. On the lingual side the upper part of the surface is similarly inclined to about 4 mm. above the enamel cementum

junction. Below this the surface is flat for about 1 to 2 mm., and then it is inclined downward and inward. This latter inclination is nearly parallel to the main inclination of the buccal surface (Fig. 10 *b*). Viewed from the buccal side, the medial surface is parallel to or slightly inclined downward and outward to the long axis of the tooth, to about midway between the coronal and cervical margins. Below this it is flat for a short area and then inclined downward and inward. The distal surface is more sharply inclined downward and outward to about a third of its height below the coronal margin and is nearly parallel to the rootward inclination of the medial surface. It is then inclined downward and inward. Diagrammatically the tooth presents the following shape (Fig. 11). The main buccal surface is parallel to the gingival third of the lingual surface. The coronal third of the distal surface is parallel to the gingival third of the medial surface. Here again the buccal, lingual, medial

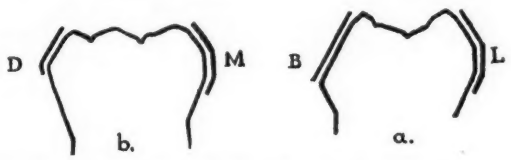

Fig. 11.—Diagrammatic drawing of mandibular right first permanent molar, with outline of plain band, (*a*) viewed from medial aspect, (*b*) viewed from buccal aspect.

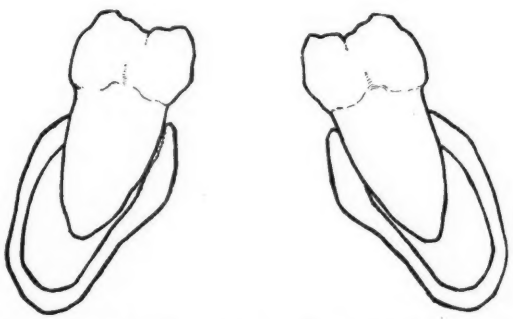

Fig. 12.—Drawing of section through the mandible and the first permanent molars. About eight years of age. Showing lingual inclination of molars.

and the coronal half of the distal surface can be banded, keeping the cervical edge of the band close to the tooth.

It must also be pointed out that the long axis of the mandibular molar, in the mouth, is inclined lingually (Fig. 12).

Fig. 13.—The procedure in making the mandibular bands or rings is slightly different. The ring is squeezed on the buccal side. After it has been fitted into place after welding, it is removed and the coronal edge treated in the same way as the maxillary molar bands. The band is festooned on the distal gingival side. A vertical cut, about 2 mm. long, is made from the cervical margin about the center of the lingual surface, the sides of the cut well overlapped and welded; a similar cut, not so long, is made from the cervical margin about the center of the lingual surface, the sides of the cut well overlapped and welded; a similar cut, not so long, is made from the cervical margin about the center of the medial surface, the sides of the cut overlapped and welded.

It must be remembered that the original squeezing of the band material around the tooth does not make the band conform fully to the shape of the lingual and medial surfaces. It will be found that there is a gap between the tooth and the band below and above the flat middle area (Fig. 14). The cutting and overlapping of the coronal corners and the cutting and overlapping on the cervical lingual and medial surfaces make it possible for the band to fit closely to the whole lingual and medial surfaces.

With regard to *deciduous molars,* material 5 mm. wide and 6.13 mm. thick is suitable. Deciduous molars, more especially the mandibular second deciduous molar, generally have a more marked inclination of their buccal and lingual surfaces. This is partly due to the belt of enamel near the cervical margin.

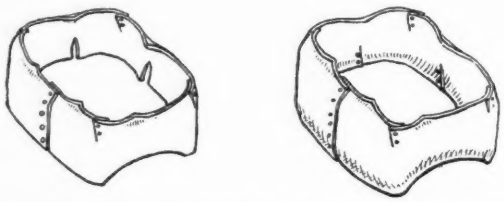

Fig. 13.—Final stages of mandibular molar band construction.

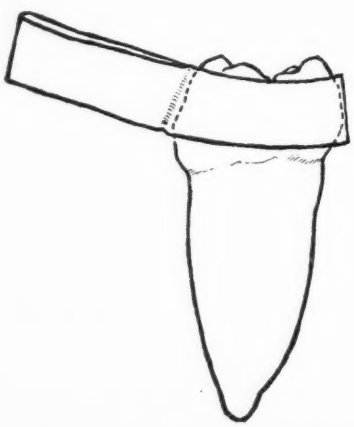

Fig. 14.—Diagrammatic drawing of mandibular right first permanent molar from medial aspect, with outline of band material squeezed together on buccal surface. Showing gaps between the band material and the tooth below and above the flat area of the lingual surface.

This belt of enamel near the cervical margin makes it almost impossible to make the band project beyond this belt and yet fit the tooth to any reasonable degree. I have found that it is not wise to extend the band beyond the enamel belt.

The rings having been made, an impression is taken with the rings on the teeth. The rings are removed and placed in the impression. A pledget of cotton wool is placed in each ring on the side to which the tube is to be attached and the impression cast. This pledget of cotton wool facilitates the removal of the plaster from the inside of the ring on the side to which the tube is to be welded.

Fig. 15.—The plaster has to be cut away sufficiently to accommodate the electrode.

2. ARCHES OR BOWS

The required type of arch is now bent to the model. Great care must be taken as no final fitting with heat can be employed.

3. TUBES

Three types of attachment of the arch to the rings will be described:

(*a*) By horizontal tubes.

(*b*) By rectangular vertical tubes.

(*c*) By round vertical tubes.

(*a*) *Horizontal Tubes.*—Tubing to fit either 1.0 mm. or 0.8 mm. wire can be obtained in long lengths. This has to be cut up into suitable lengths with a three-cornered file.

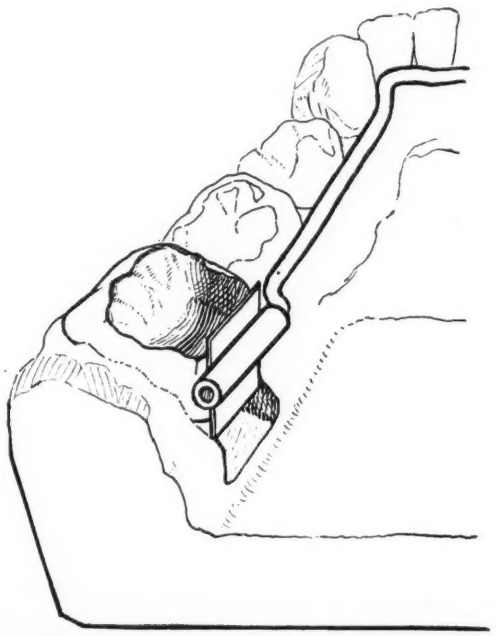

Fig. 15.—Drawing of model with half the plaster removed from inside of molar plain band on side to which the tube is to be welded. Lingual arch with horizontal tube and flanged attachment ready to be welded.

It is evident, from the shape of the lingual surface, that the tube will only touch the ring at one point and that this would not give sufficient strength when welded (Fig. 16). Consequently the tube is ground on a stone on the lathe on one side fairly deeply, the ground surface being about 5 or 6 mm. long and 1.5 mm. wide. A piece of ribbon material polished on one side, 0.2 mm. thick and 5 or 6 mm. wide, is laid on the ground portion of the tube and held between the electrodes of the welder. The electrode (*c*, Fig. 24) in contact with the tube is grooved at its point transversely, 4 mm. wide in line with groove and 2 mm. long across groove. The other electrode (*a*, Fig. 24) is a fine point. This electrode is in contact with the unpolished side of the ribbon material. High speed is used in welding the ribbon to the tube along the length of the ground surface of the tube.

(*b*) *Rectangular Vertical Tubes.*—The tubes, with their flanged attachments, are put on the arch and are placed on the model (Fig. 15). The tube is welded to the ring on the model at the point of contact right through tube, arch, ribbon material and ring. The electrodes *a* and *b*, Fig. 24, are used. Then the ribbon material is bent with pliers (118, S.S. White) to fit closely to the ring, coronal to the tube and welded to the ring at a couple of places, medium speed. The rings are now removed from the model, the ribbon material closely bent to the ring and welded, medium speed. The surplus of ribbon material is cut off and ground smoothly with a stone.

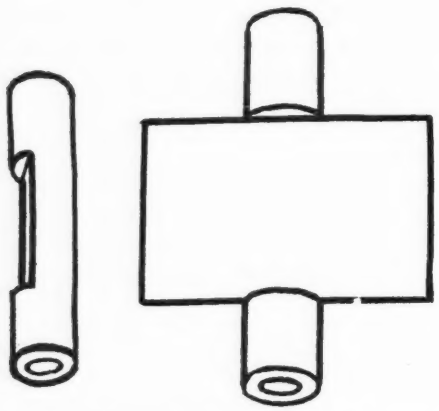

Fig. 16.—Drawing of tube ground on one side; tube and ribbon material.

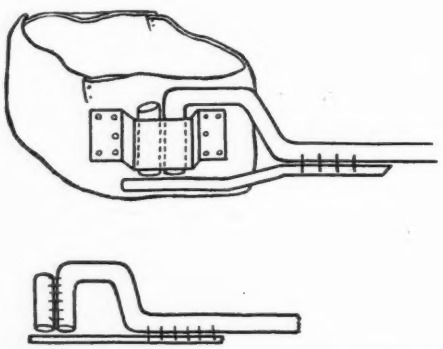

Fig. 17.—Drawing of end of arch bent at right angles, with a piece of similar wire welded to it, forming the rectangular pin which engages the rectangular vertical tube. Soft wire latch welded to arch to engage bottom of vertical tube.

Fig. 17.—The ends of the arch are bent at right angles. To this right-angled pin is welded a piece of wire of the same thickness, so that the single pin is now double, both lying in close contact with the ring on the molar, electrodes *d* and *d*, Fig. 24.

Fig. 18.—A piece of 0.2 mm. ribbon, the width of the height of the pin and about 14 mm. long, is stamped with a punch over a double wire similar to the double pin. This stamped piece of metal constitutes the outer and side walls of the vertical rectangular tube, the ring constituting the inner wall (Fig. 17). The ends of the stamping where they project beyond the side walls of the tube are welded to the ring on the model, two fine-pointed electrodes (*a* and *b*, Fig. 24) being used, medium speed.

(*c*) ***Round Vertical Tubes.***—Where it is desired to rotate the molars, round strap vertical tubes are used. These are made in the same way as the vertical rectangular tubes, and the same electrodes and current are employed.

Latch for Vertical Tubes.—The ends of the pins are cut off flush with the cervical ends of the tubes. A piece of soft steel, 0.7 mm. thick, is welded to the arch as a latch (Fig. 17). The electrodes *d* and *d*, Fig. 24 used are very narrow and are grooved transversely to hold the wires, high speed.

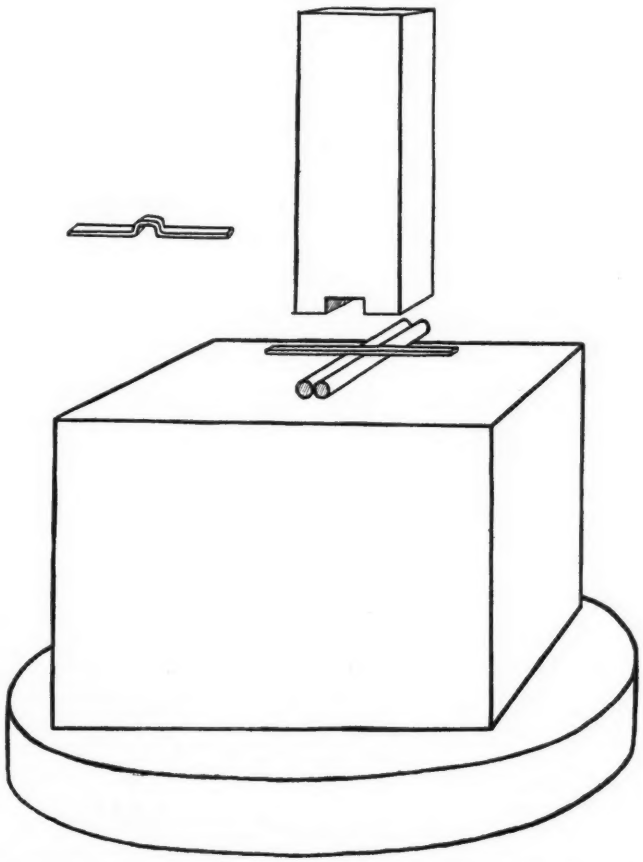

Fig. 18.—Construction of strap vertical tubes. Punch, ribbon material, double wire and anvil.

4. AUXILIARY SPRINGS FOR LINGUAL ARCHES

The attachment of auxiliary springs to the arch presented many difficulties, and the method found most satisfactory is as follows:

Fig. 19.—The end of the spring wire is sharply curved, the curve being about 1 mm. This curved portion is hooked under the arch at the place where it is desired to weld it, thus being at right angles to the line of the arch. The curved portion lies between the arch and the gum, the main coil of wire extending forward. The spring wire rests in a large grooved electrode (*e*, Fig. 24) 2.5 × 3.5 mm. at the point, so that it cannot be flattened out during welding, and a pointed electrode (*a*, Fig. 24) is used on the arch, 2.0 mm. diameter at the

point. Medium speed is used. The spring wire is then held firmly and bent a further quarter turn around the arch and the spring welded again with low speed.

Fig. 20.—Now the spring is given three complete turns around the arch, the coils being as close together as possible. This makes a very efficient spring as long as pressure is exerted to tighten the coils, but most inefficient if pressure should be exerted the other way. In the latter case a tearing force is exerted on the weld and it very easily breaks. To prevent pressure being exerted in this direction, a strap is welded at each end to the arch across the three turns. This acts as a stop, preventing the spring being unravelled. The auxiliary spring is now completed into whatever form is required.

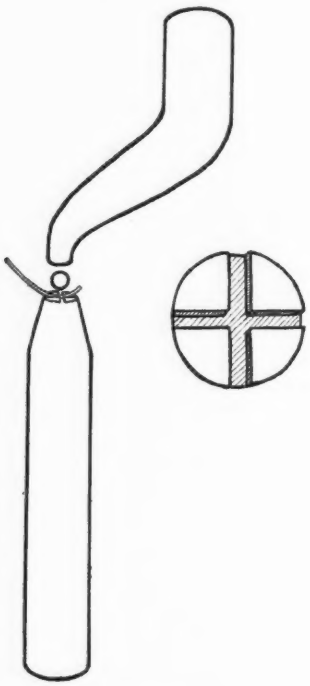

Fig. 19.

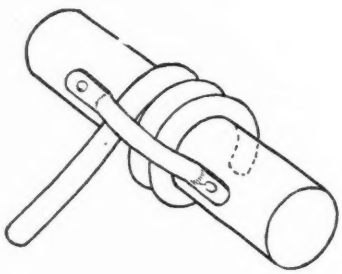

Fig. 20.

Fig. 19.—Drawing of construction of auxiliary spring. Electrodes (*a* and *e*).
Fig. 20.—Drawing of construction of auxiliary spring. Coils around arch and strapping.

The efficiency of the auxiliary spring depends upon at least three factors:

(*a*) Elasticity of the material, so that there can be considerable range of deflection before reaching the bending point.

(*b*) Stability. It is essential that the spring is reasonably safe and is not easily displaced or broken.

(*c*) Action in direction desired only.

Stainless steel hard drawn 0.4 mm. diameter offers an extremely elastic material, and this elasticity can be improved by the form of the spring. It is possible to have a pressure not exceeding a maximum of 2 oz. on each tooth with a deflection of 4 mm. Such springs can be left safely for three months

without alteration. They apparently move the teeth with far less tilting than stronger springs. This may be due partly to the direct action of the spring to its stability and to the gentleness of the force. The forces of occlusion may assist considerably in keeping the teeth upright when the pressure of the spring is very weak. It is important that *the coils when the main spring is deflected should tighten rather than open.*

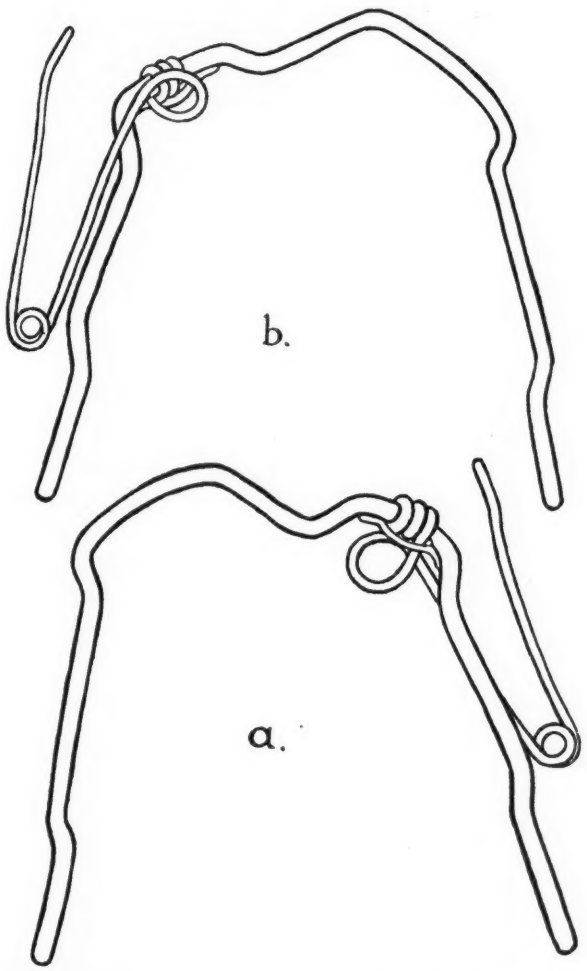

Fig. 21.—Drawing of double auxiliary spring for buccal movement, (*a*) viewed from side away from gingiva, (*b*) viewed from side in contact with gingiva.

I shall describe the construction of four types of auxiliary springs:

(1) A spring for buccal movement.

(2) A spring for labial movement.

(3) A spring for molar rotation.

(4) Retraction springs.

(1) *A Spring for Buccal Movement.*—Fig. 21.—The spring is welded at right angles to the arch, and lying between the arch and the gum about 3 mm. medial to the angle that the legs of the arch make with the front, probably op-

posite the lateral incisor. After the three complete turns around the arch and the strapping, it is given a single coil medially and brought back following the line of the arch as far back as expansion is required, the spring being between the arch and the gingiva. Then, with very fine tapered pliers, one nose around, the other flat, a small double coil is made, the coil being buccal to the first arm of the spring. The second arm is brought as far forward as expansion required. It is possible with such a spring to form it so that the type of expansion required is obtained. Its action is much more direct than a single-armed spring. The pressure is less and is more evenly distributed over the whole bearing sur-

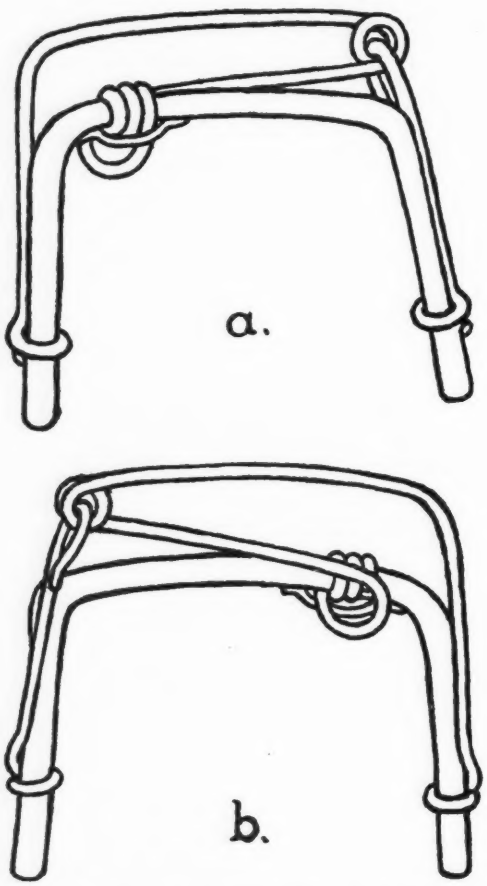

Fig. 22.—Drawing of double auxiliary spring with captive ends for labial movement, (*a*) viewed from side away from gingiva, (*b*) viewed from side in contact with gingiva.

face. With a single-armed spring the pressure increases and the deflection decreases rapidly from the free end to the point of attachment.

(2) *A Spring for Labial Movement.*—Fig. 22.—This spring is an improved form of the lateral spring. A spring similar to the lateral spring has several disadvantages in the front of the mouth. It frequently rides on the inclined surfaces of the incisors and is then not acting in the direction required. The free end and the angle of the recurve are liable to get caught up by either food or the tongue. The spring is constructed the same as the lateral spring, but the free end is bent at nearly a right angle and passes underneath the corner of

the arch and is twisted around the leg of the arch. The angle of the recurve is held in position by a piece of 0.4 mm. wire looped around the curl and welded, the free end being brought underneath the corner of the arch, and twisted around the leg of the arch. Such a spring has a concertina action, the guides running on the legs of the arch. These guides are much more efficient than guiding spurs in keeping the spring in place and in keeping its action in the right direction.

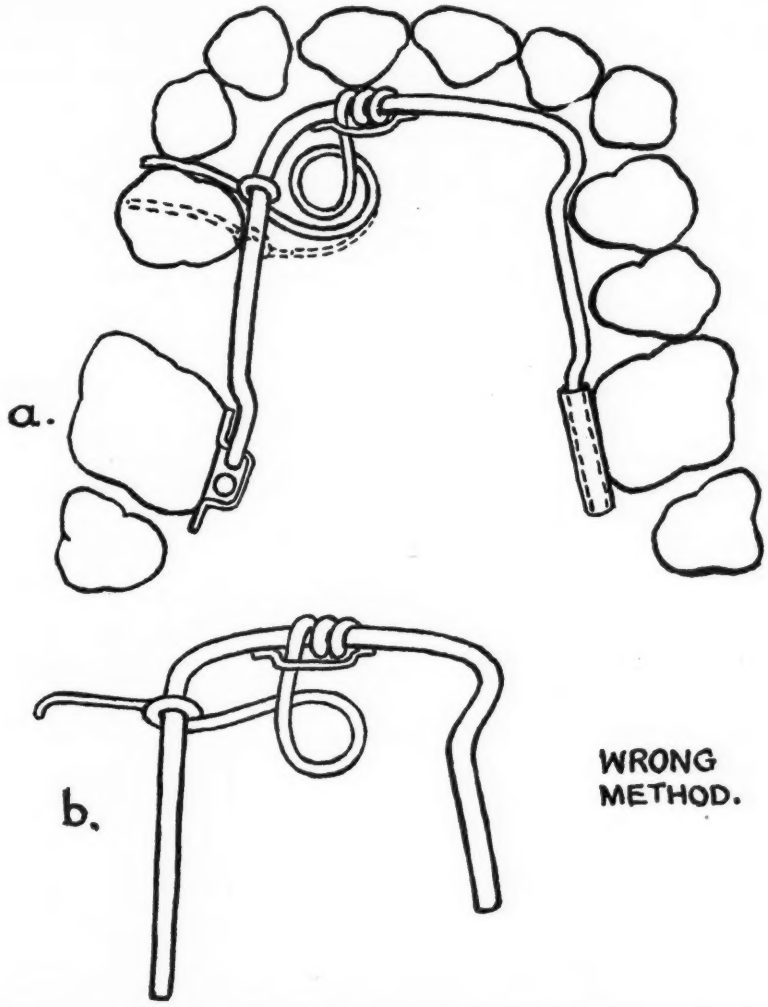

Fig. 23.—Drawing of retraction spring, (*a*) deflection of spring tightens coils, right method, (*b*) deflection of spring opens coils, wrong method.

The electrodes for welding the loop around the angle of the recurve are two large grooved electrodes (*e* and *e*, Fig. 24) and low speed is used.

(3) *Molar Rotation Spring.*—This spring has been described by me, before this Society, in 1927. The 0.4 mm. wire is welded to the back of the molar ring, using a grooved electrode (*e*, Fig. 24) for the wire and a pointed electrode (*a*, Fig. 24) for the inside of the ring. Low speed is quite sufficient.

(4) *Retraction Springs.*—Fig. 23.—This spring is very useful for the retraction of a canine or for moving any tooth along the line of the arch in either

direction. Great care has to be taken that when the spring is deflected it tightens the coil.

5. LABIAL EXTENSIONS FROM LINGUAL ARCH

(1) Retraction and lingual movement of canine.

(2) Lingual movement of incisors.

(3) Rotation of incisors.

These labial extensions have to be made of thicker wire than the auxiliary springs; 0.6 or 0.7 mm. are the most suitable sizes. Here again the extension is welded underneath the arch, i.e., gumward and coiled once round the arch and

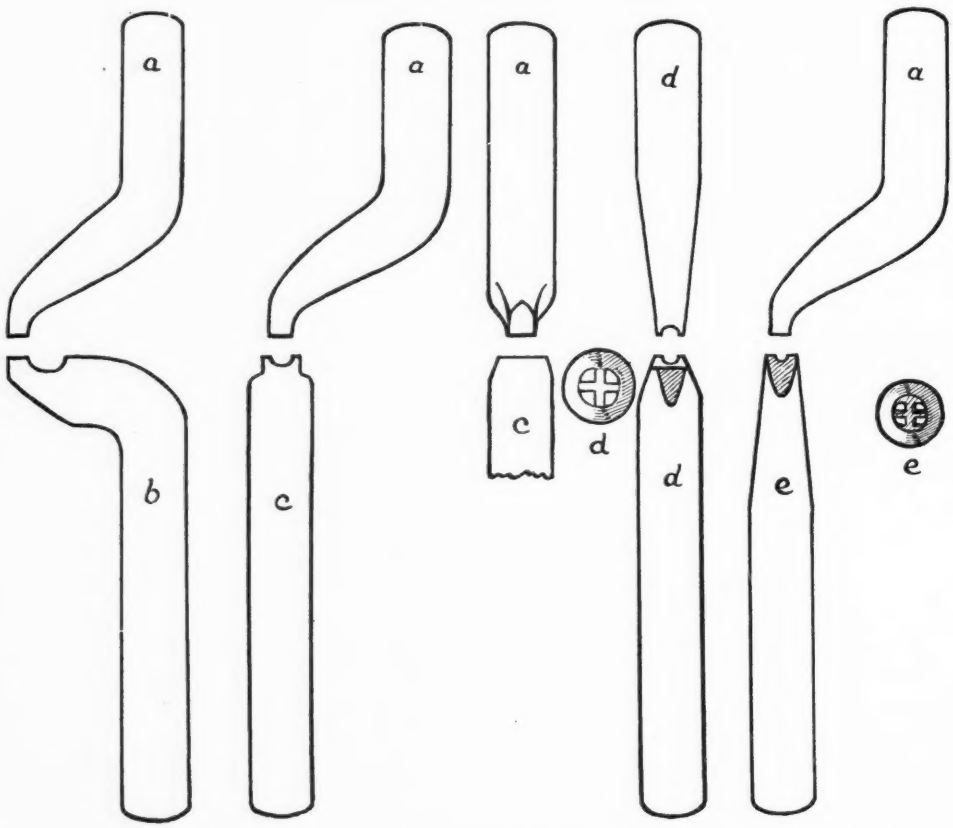

Fig. 24.—Drawing of electrodes *a, b, c, d, e; a* and *b* for band material; *a* and *c* for band material to tubes; *d* and *d* for thick wires; *a* and *e* for spring wire to arch wire.

then brought out between two teeth. Grooved electrodes (*d* and *d*, Fig. 24) are used in order not to flatten out the wires too much and high speed current.

6. HOOKS FOR INTERMAXILLARY TRACTION

(1) Hooks on buccal arch.

(2) Hooks on molar bands.

Hooks on the buccal arch are best made of wire 0.8 mm. thick, the arch and the wire for hook being filed a little to give better contact, using narrow transversely grooved electrodes and high speed (*d* and *d*, Fig. 24). Hooks on the

molar bands are welded obliquely from the mediobuccal occlusal angle to near the cervical margin and then bent outward, and inward.

The appliances described are a fair example of those used by orthodontists who do not use ready manufactured appliances, and show the possibilities of this material and the method of welding.

I am very grateful to Dr. De Coster of Brussels for having initiated me into the use of electric welding, and to Mr. H. T. McKeag and my brother, Mr. Ralph Friel, for the great help they have given me in the writing of this paper, and to Miss Wilson for all the drawings. I would also like to thank Mrs. Lindsay for the great amount of trouble she took in obtaining information for me.

APPENDIX

1. HORIZONTAL ROUND TUBING.

Inside diam. 1 mm. Outside diam. 2 mm. = 0.039″ × 0.078″	}	Thick walls.
Inside diam. .8 mm. Outside diam. 1.8 mm. = 0.031″ × 0.070″	}	
Inside diam. 1 mm. Outside diam. 1.5 mm. = 0.039″ × 0.059″	}	Thin walls.
Inside diam. .8 mm. Outside diam. 1.3 mm. = 0.031″ × 0.051″	}	

2. BAND MATERIALS.

Polished one side. In soft state.
0.2 mm. × 11 mm. Used for making vertical tubes, strapping for horizontal tubes, and for making horizontal tubes.

0.15 mm. × 5 mm. = 0.0058″ × 0.196″	*Permanent molars.*
0.15 mm. × 6 mm. = 0.0058″ × 0.236″	
0.13 mm. × 5 mm. = 0.0050″ × 0.196″	*Deciduous molars.*
0.08 mm. × 5 mm. = 0.0031″ × 0.196″	*Incisors.*
0.08 mm. × 6 mm. = 0.0031″ × 0.236″	

3. WIRE. POLISHED.

1 mm. diam. = 0.039″	Fairly hard.
0.8 mm. diam. = 0.031″	Medium hard.
0.7 mm. diam. = 0.027″	
0.6 mm. diam. = 0.023″	Hard.
0.4 mm. diam. = 0.015″	
0.7 mm. diam. = 0.027″	Soft, for latch wire.

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DISCUSSION

Mr. W. A. Bulleid desired to congratulate Dr. Friel on the extraordinary ingenuity which he had shown, as he had done on previous occasions, in these mechanical contrivances. His ingenuity was quite amazing. There was one omission which he noted. Dr. Friel had not told the Society what rustless steels he was using, for their name was legion. Two quite distinct groups were the chrome steel and the chrome nickel steel. He presumed he used the chrome nickel steel. The speaker had been using rustless steel exclusively for the

last twelve months in orthodontic work and also in plate work. He was using Firth Staybrite F.S.T., a hard-drawn steel which did not lose its temper very much by heating. This could be obtained in any section and diameter required. He had also been using it for making bands. There again Dr. Friel had not told them what steel he used for bands, and it would be of interest to hear. He felt inclined to traverse entirely Dr. Friel's statement with regard to soldering these steels, and he did not care what solder it was that was used. The solder that was recommended was a turbine brand of silver solder. But if it was preferred to use the high-grade gold solders such as were sold by S. S. White, and which were formerly used with the gold platinum alloys, these were quite satisfactory. For his part, he preferred soldering to welding, especially when it came to attaching the light wires to the heavy arches. He found that the weld did in fact draw the temper of the light wires very materially. He had been immensely interested in the springs which the author had shown; they were very ingenious, but he desired to ask whether he found any tendency for the welds to snap. As Dr. Friel had stated, it was an extremely small area of attachment, and his own experience, which was not so great as Dr. Friel's, had been that these springs broke off at the point of weld. With the solder this difficulty was obviated to a great extent. On the question of welding his attachment to his bands, the method which Dr. Friel had shown appeared to him rather elaborate, and he wondered if he did not find a substantial distortion of the bands as a result of welding. He had found that when welding a steel band to a plate, the weld had slightly distorted it.

Mr. Visick said that the Society had expected something practical and artistic from Dr. Friel, and had not been disappointed. The only trouble was that he made it all appear so simple that he suspected there was a snag somewhere. He wondered whether the "snag" was not technical skill in using his welding apparatus. The speaker himself had never tried to use one of these; they all looked very clumsy when dealing with tiny objects. He wished to ask Dr. Friel whether he had ever found that after welding one spring wire satisfactorily, on welding another he made a false shot and spoiled the arch and the spring wire. That would give some idea as to whether it was easy to do these weldings. He was afraid that he had had so little experience of stainless steel that he could not say anything useful on the subject, but during the last few months or year he had been experimenting with stainless steel. The soft solder joint had been tried, but in their hands it had not been satisfactory. The soft solder had corroded and the spring wires had got loose, but he had been using an arch and finger springs made of one piece of wire, and an example of this he showed to the meeting. It was really a latch spring which was extended forward and became a finger spring. The chief point in stainless steel, apart from its cheapness, seemed to him its marvellous elasticity. It seemed twenty times better than any precious metal he had ever tried. Once one had got a spring formed one could hardly destroy it at all. It might be pulled out inches and it would spring back. He showed a specimen which illustrated the marvellous springing properties of this stainless steel. With regard to the bands, he supposed that really one could not contour them in any way except by splitting and bending them together and resoldering.

The President (*Mr. H. G. Watkin*) said that he had been using stainless steel for about ten months, and, owing to Mr. Bulleid's help, he had been entirely relying on soldering. At the last demonstration meeting he had mentioned that soft soldering had not been a success, but hard soldering had been successful. It was necessary to have a very small flame, about ⅜ in. long. With regard to cutting tools, Dr. Friel had said that steel wire was very hard on the cutters. For his own part, he got the cutters bright red hot, and dipped them in cold water, whereupon they were "glass" hard. He had been privileged to attend a meeting in Dublin last year at which Dr. Friel gave a demonstration on this subject, and he had used his lingual spring several times since and had found it excellent. He could not see a great advantage of welding over soldering. Soldering was a perfectly good joint, but it required polishing afterward. The special "turbine" solder kept perfectly nice in the mouth. For a straightforward seam welding was very easy and quick, but if

two curved surfaces had to be welded, even Dr. Friel had to file one flat so as to get the surfaces to make a proper joint, whereas one soldering joint made a good job of it and avoided the necessity of filing. He exhibited an example of soldering the tube to the band, and he also showed an example of welding without loss of temper. In conclusion, he congratulated Dr. Friel on the success he had obtained and on the excellence of his drawings.

Mr. Cale Matthews said that in the latter part of last year, he had a very kind invitation from Dr. Friel to attend a meeting in Dublin, but unfortunately he was unable to be present. He had been a few moments late in arriving at the meeting, and he did not know whether in the earlier part of his paper Dr. Friel had entered into the constituent materials he was using, but he had very kindly supplied him with a detailed list which coincided almost exactly with one with which Mr. Bulleid had supplied him a few days earlier. The Society had heard many of Dr. Friel's papers and had seen so much of his work that it was absurd to congratulate him. They knew when he was about to demonstrate to them that they were to see something as near as possible to perfection. The technic he had developed was extraordinarily ingenious, but he would like Dr. Friel to tell them where his actual saving came in. Was it in respect of time, or was it in cost of materials only? It seemed to him that the process took up a considerable amount of time, particularly in the banding. He thought Dr. Friel would agree with him that with the old alloy metals it was possible to make a decent band in anything from fifteen minutes to half an hour, but the method now advocated by Dr. Friel appeared to him to be a very much longer operation. Was it work which had to be done entirely by himself or could some of it be transferred to a mechanic?

Dr. Friel, in reply, after thanking the members for their reception of his paper, said that Mr. Bulleid would find in the paper itself, portions of which he had not read that evening, a reference to some of the points he had introduced, in particular a list of the gauges of the steel used. With regard to patent rights, Krupps had an English patent for the use of stainless steel in the mouth, and had prevented the sale of English steel for orthodontic work. It is doubtful if the patent would hold in a court of law. It had been contested in Belgium and had not been upheld. The patent expires in May, 1935, and it was desirable for the profession to see that it was not renewed. With regard to soldering versus welding, it was very difficult to answer the question as to comparative merits when one had done welding only, and not soldering. But he did feel strongly on the subject of putting a black arch into a child's mouth. His great objection to gold and German silver had been the difficulty of keeping them clean. One would not put a black plate into an adult patient's mouth, so why should one do it in the case of a child? The child's feelings should be considered just as much as those of the adult. He had been asked whether the springs snapped. They did not when one coiled the spring around the arch. At first he had dozens of breakages, but for the last five or six months there had been no broken springs at all.

Mr. Visick had suggested that there was some snag about the business. But it was really quite simple. Anyone who was over in Dublin last year would bear him out that it was quite a simple process, and that one became very quick at it. He thought the time occupied, on the whole, was very much the same as with gold alloys. Mr. Cale Matthews had said that he could make a band in from fifteen minutes to half an hour. Well, by this process he could make two bands in twenty minutes, whereas before it took him half an hour to make the two in gold alloy. The welding of the spring was done very rapidly. Mr. Visick had asked whether he botched the arch in putting in the second spring. He certainly did this in the beginning but that had not happened now for many months. One could put the springs as close together as one pleased with welding. If one wished one could put on an anterior spring and a lateral spring at the same time, the two joints almost touching, and as far as he knew he had not been losing temper in his spring wire, at least not since it had been coiled over. The President had asked him a difficult question, but

fortunately a kind friend had leaned over to him and given him the answer. It was on the primary circuit that the switch worked. Mr. McKeag, in Belfast, had been using soldering a good deal. He said that in soldering stainless steel one did not get an alloy between the two, but it was only a sticking of the two parts together, and he stated that he had a fair number of horizontal tubes breaking off by reason of a sudden stress. The speaker did not know whether that was the experience of the other workers. Mr. Cale Matthews had asked him whether the mechanic could do a good deal of the work. His own mechanic bent up the arches for him, which was the hardest job, but all the welding he did himself. It was most interesting work. He personally, if gold were now sixpence a pound, would not go back to it, because this was much more interesting and gave him an enormous amount of pleasure. One could use one's ingenuity in making the springs and appliances in a way which one never thought of before.

A METHOD OF SOLDERING HALF ROUND WIRE TO LINGUAL BASE WIRE*

CURTIS WILLIAMS, D.D.S., SHREVEPORT, LA.

IN THIS period of orthodontic development, there have been many different types of attachments for the lingual appliance. Many types have been developed in trying to stabilize the attachment.

I have been soldering the half round shafting on the base wire for lingual appliances in the following manner for some four or five years, and it has almost eliminated my breakage, and it does stabilize the arch.

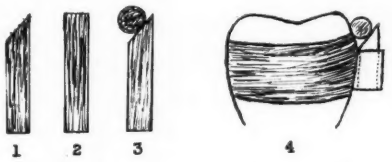

Fig. 4.—Anterior view.

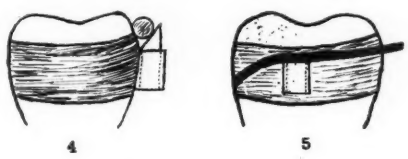

Fig. 5.—Lingual view.

I file the half round shafting to about an angle of 45° (Fig. 1) instead of filing it square across, as in Fig. 2.

Instead of soldering the half round shaft directly beneath on the base wire, I let the angle go to the side of the base wire (Fig. 3). When the half round shaft is then placed in the half-round tube, it will throw the base wire against the band, as in Fig. 4.

The base wire being against the band and the shaft not being completely set in the tube allow the appliance to tighten under the stress of mastication, no food getting between the base wire and the band.

The end of the base wire is bent around the distolingual angle of the band. (Fig. 5.)

*Presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, Okla., Nov. 8-10, 1933.

DEPARTMENT OF
DENTISTRY FOR CHILDREN

CHILDREN'S DENTISTRY AND ORTHODONTIA*

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CHILDREN are the greatest asset to a growing, progressive country provided they are given what they are entitled to in this age of civilization. A country that does not give its children the full rights and benefits which, education has taught us, belong to them, is not a progressive country, and the people become narrowed and selfish.

Therefore, just how great an asset children are, depends largely on the environment in which they are brought up. They will do their part, and more too, provided those to whom they look for advice and leadership are striving to give them what is their due. The normal child, and most children are normal when they begin life, is much quicker to receive impressions than is the adult. Children look up to their parents, their teachers and others with whom they come in contact, and without the necessary knowledge to understand why such a thing is for their own good, they, full of confidence and trust, place themselves under the care of those who know by experience and learning what is right. If they find that the right thing is being done for them, they, like all good soldiers, are quick to understand and equally quick in showing their appreciation. It is up to us as dentists to teach them and give the kind of dentistry they deserve, which should be nothing but the best.

Children's dentistry and orthodontia are closely related in all phases to the study of development and growth. It is my purpose to try to show you how simple everything is when the development is normal, and then to show you how the slightest deviation from normal may later become a most complex abnormality if not corrected. All complexities start from some simple deviation from normal, which in most cases at the time it first started could have been easily corrected. In correcting malocclusion of the teeth it sometimes happens that the real cause has started before any noticeable abnormality in the jaws occurs; therefore, it is doubly important that as soon as any abnormality is noticed in the dental arches it is high time to take active steps in preventing a worse condition.

NORMAL DEVELOPMENT

The earliest suggestion of the oral cavity is what is called the stomodeum, and makes its appearance about the thirteenth day of embryonic life on the ventral surface of the cephalic end.

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About the end of the third week a series of conspicuous elevations or processes are developed around this opening from the front and sides. The one coming down from the front is called the frontal-nasal process; those coming from the sides, the visceral arches, of which there are five pairs.

We are interested in the formation of the mouth and the face with the first visceral arch, which, with the frontal-nasal process, goes to make up these parts.

The first visceral arch forms itself into a short maxillary process and the longer mandibular process below. The two maxillary processes with the frontal-nasal process, which descends as a projection from the anterior portion of the head, form the superior and lateral boundaries of the oral cavity and the nasal region. The mandibular processes form the lower jaw. A cartilaginous rod, known as Meckel's cartilage, serves as a support for the forming mandible and later becomes absorbed after it has served the purpose of support.

During the fifth week the frontal-nasal process divides into mesial nasal processes, which together with the lateral nasal processes, form the inner and upper boundaries of the so-called nasal pits. The naso-optic groove lies between the lateral nasal process and the maxillary process, and leads from the nasal pit to the angle of the eye and marks the position of the naso-lachrymal duct.

About the end of the sixth week the maxillary process fuses with the frontal-nasal process as well as with the lateral nasal process, thereby separating the oral cavity and the nasal pits.

Let me show you what these fundamental parts go to form. The lateral nasal processes form the alae of the nose. The mesial nasal processes form the septum of the nose, the bridge, the middle portion of the upper lip, and the premaxillary portion of the upper jaw, which contains the four incisors. The fusion of the maxillary and mesial nasal processes forms the primitive palate. The premaxillary and palatine processes join in the eighth week. These processes, together with the two palatal processes of the palate bones, constitute the hard palate.

Coincident with the development of these parts which has just been described, is the development of the teeth. The primitive dental ditch makes its appearance about the middle of the second month. From this dental ditch extends the tooth band, and from this latter arise the tooth bulbs.

Up to about the tenth week these bulbs are not definitely separated from the surrounding cellular structure, but at this time the tooth germs become enveloped in what is called the tooth sac, this, together with its contents, forming the tooth follicle.

I shall not go into detail concerning the development of the various parts of the tooth. It is the purpose of this paper simply to show the close relationship, from the very beginning, of the teeth, mouth, nose, and other parts of the face. In order to practice dentistry and more especially orthodontia, successfully, it is necessary to have a clear understanding of these closely associated structures. We all know that the human body is a delicate and

complicated piece of machinery, and yet it has the power to run with the greatest simplicity. This simplicity is controlled to a large extent by the proper adjustment of the various parts during the process of formation and development, and by a more thorough understanding of this phenomena we can more clearly realize how accurate everything must be, and how a very minute displacement not only will tend to become a great deal more prominent as time goes on, but is bound to have an effect on closely associated structures. The severity of any abnormal tendency is increased the earlier it occurs, and its corresponding disastrous effects are more widespread. In the beginning, one small process has in it the possibilities of what becomes through the stages of growth and development a specialized anatomical structure or structures. Until this period of growth and development is completed there is a close relationship between the various parts which decreases as each part becomes less dependent on another, and its character more specialized.

This paper would not be complete without showing the relationship of the accessory sinuses. An orthodontist is concerned in the molding of the bones of the face; and one of the important rôles of the sinuses is in the transformation of the infantile face into the adult type. Some of the functions of the sinuses are: to promote resonance of the voice, to defend the brain against shocks, and to lessen osseous weight of the head without impairing the strength. These cavities are five in number, the frontal, maxillary, anterior ethmoidal, posterior ethmoidal, and sphenoidal. The frontal, maxillary, and anterior ethmoidal sinuses open into the middle meatus of the nose. The posterior ethmoidal and sphenoidal sinuses open into the superior meatus of the nose.

In the latter part of the third month of embryonic life the turbinates have definite outlines. During the fourth month the anterior and posterior ethmoidal cells develop as invaginations of the nasal mucosa, and by the sixth month of fetal life usually show distinct cell formation.

The sphenoidal sinus begins development about the last of the second or the first of the third month, and is first noticed as a slight depression. This sinus is fully formed at about the sixteenth year.

The frontal sinuses are the only ones that are not present at birth. These do not appear until toward the end of the first year or later. Up to the sixth or seventh years they are about the size of a pea, and are recognized as separate and distinct cavities between the seventh and ninth years.

The maxillary sinus is the most constant of the accessory sinuses, and the extent of its development is also the most regular. The primitive antrum appears in the embryo about the end of the third month. In early childhood the general outline of this cavity is rather ovoidal, but after the fifth year it gradually changes into a quadrilateral pyramidal form, and with the downward development of the alveolar process it increases in size reaching its final form after the eruption of the last permanent tooth. The size of the antrum in the newborn is about the size of a small bean, and up until the eighth year the diameters increase at a rate which was found to average

approximately 2 mm. each year in both the vertical and the lateral diameters and 2 mm. anteroposteriorly. After the eighth year the development advances more slowly in all directions. The floor of the sinus reaches a level equal to that of the floor of the nasal fossa during the eighth year, and in the majority of cases after that, it is from 1 mm. to 5.5 mm. below the level of the nasal floor. The floor of the antrum in all stages of its development is in close relation to the teeth, and the increase in the vertical diameter of the sinus is found to be much more a process of expansion as the body of the maxilla increases in size, than it is one of resorption of cancellous bone previously occupying the area. The typical antrum floor may be considered as one which overlies the roots of all the molars and the posterior portion of the second premolar; although there is considerable variation in the relation which the teeth bear to the antrum.

So far I have tried to bring out what we might term the origin of the parts in which we are interested, and to show the exceedingly close relationship of these parts in the early stages of formation and development. Before proceeding further with this outline it will be well to review some portions of the preceding, and at the same time point out how some of the early cases of malocclusion start.

It is a known fact that there is a small percentage of children who have malrelations of the jaws at birth; and although all of the causes for these early cases are not yet known, nevertheless, there are very good logical reasons why some of these conditions occur.

Dr. Weinberger of New York has found that a great many early abnormal conditions can undoubtedly be attributed to the pressure of the fetal membrane, or amnion. This pressure of the surrounding membrane of the fetus if brought to bear too much on the head curve, will, from the coiled condition which exists, push the region of the visceral arches and the future face against the organs of the chest and the chest wall and, if the pressure is great enough, will interfere with the blood supply, causing a disturbance of circulation, a temporary disturbance of nutrition, and a stunting of growth of the affected part.

Dr. Weinberger and others also bring out the statement that development is markedly influenced by internal secretions, affecting growth or general nutrition of the body. The effect of these on the tongue, jaws, and teeth is bound to have its effect from an orthodontic standpoint.

Failure in the fusion of the maxillary with the frontonasal and lateral nasal processes, causes harelip and cleft palate, the clinical variety of the cleft depending upon the extent of nonfusion between the processes.

We see that in the formation of the hard palate the union of the bones entering into it forms six sutures. Faulty closure of any of these sutures suggests another cause for early maldevelopment of the jaws.

FURTHER STEPS IN GROWTH AND DEVELOPMENT

To continue further with the subject of growth and development I shall start with the skull at birth. The relative proportion between the cranial

and facial regions at birth is in a ratio of 8:1; at five years of age, 4:1; at adult age, 2:1. These differences are chiefly due to the small vertical diameter of the maxillae, the rudimentary condition of the alveolar borders of the maxillae and mandible, and the small size of the nasal fossae at birth.

The eruption of the teeth, first the deciduous and later the permanent ones, makes great changes in the structure and size of the face.

At the end of the first year the child should normally have the eight incisors. At the end of the second year the four canines and the four first deciduous molars; and before the third year all the deciduous teeth should be in position.

By far the larger percentage of children arrive at the age of three years with what appears to be normal occlusion. The teeth represent an even alignment with very little overbite. There is no occlusal curve, this being developed with the eruption of the premolars. The short ramus results in the condyle and occlusal planes being nearer together. In the articulation, the fossa is not so deep nor the eminentia so high, and consequently the condyle path is more nearly a straight line.

The further development of the head and face, coincident with the eruption of the permanent teeth, proceeds simultaneously for greater breadth, length, and height, and there seem to be distinct periods for the different kinds of growth.

With the eruption of the first permanent molars the jaws show a considerable growth in depth.

The breadth of the face is increased beginning at about the age of four or five years, by the gradual separation of the deciduous incisors, and this broadening of the face continues until the eruption of the permanent successors takes place.

The shedding of the deciduous molars and the eruption of the premolars result in an increased vertical growth of the face, and is the first step in the development of the adult occlusal curve.

The canines are the keystone of the arch curve, and their eruption causes still further depth as well as breadth of the face.

The eruption of the second permanent molar like the first permanent molar causes an increase in the depth of the face.

CAUSES OF MALOCCLUSION AND EARLY STEPS FOR CORRECTION OR PREVENTION

After having briefly outlined some of the stages of development in the growth of the child it will now be necessary to start at the time of birth and trace the abnormal conditions that tend to cause malocclusion.

One of the first is lack of normal development noticed in babies that are brought up on the bottle; and it has been demonstrated that breast-fed babies are better developed because of the effort required which is one of Nature's forces for natural development. Also the mother's milk is the natural food and possibly contains elements not found in other food.

Another early factor in determining normal or abnormal occlusion is cell metabolism. Normal cell metabolism is the proper physiologic development

of the cells that have to do with eruption of the teeth and the development of the surrounding parts. Therefore, any abnormal cell metabolism is bound to manifest itself in abnormalities of the teeth and jaws.

Abnormal frenum labium, where the attachments of its fibers are so deep that the central incisors become separated, is another cause. In these cases it is often necessary to dissect out the frenum.

One of the most important and most serious of causes in many of the early cases of malocclusion is nasal obstruction in the form of tonsils and adenoids, deflected nasal septum, polyps of the nose, or any other foreign growth that may cause mouth-breathing. The typical adenoid patient with its marked characteristics is familiar to all of you, the narrow maxillary arch, the protruding maxillary incisors, short upper lip, underdeveloped mandible and chin, external nares underdeveloped, lack of development all through the nasal region, together with the vacant stare of the child and the characteristic dull look. These conditions are chiefly due to the abnormal muscle pressure, lowered atmospheric pressure, and inability to swallow properly.

Abnormally enlarged tonsils are often the cause of Class III malocclusions or protruding mandible. Owing to the inflamed condition of the tonsils the child pushes the mandible forward to relieve this pressure on the inflamed parts, and the result is often a locking of the mandible in this forward position.

The next of the important causes of malocclusion are the various child habits, such as lip-biting, thumb-sucking, or continued biting of some article of clothing. To be sure, the force applied in pursuing one of these habits is not great, but the constant application of it is bound to have an effect on the pliable framework of the jaws in the young child.

Food and the manner of eating are very important factors in developing normal jaws. The child should have hard food that requires chewing in order to give the necessary stimulation through exercise to the jaws.

Certain constitutional diseases, such as rickets, syphilis, scarlet fever, measles, and others affecting the heart, lungs, and glands of internal secretion, all produce their effect on the jaws and teeth.

Heredity plays its rôle in connection with the shapes of the dental arches equally as much as it does in other inherited characteristics, and in correcting a case of malocclusion due consideration must be given to this factor.

Some other causes are supernumerary teeth, congenital absence of teeth, hypertrophy of the tongue, mutilated cases due to loss of permanent teeth, and faulty eruption of teeth.

I have reserved until last the causes of malocclusion that are associated directly with the deciduous teeth. These cases that result from premature loss of deciduous teeth or from too long retention of the deciduous teeth are conditions that are much too prevalent and are among the ones that we as dentists have under our control. Careful attention of the deciduous teeth with conscientious operative procedure on the part of the dentist will not only be accomplishing the right kind of dental treatment but also be doing preventive orthodontia as well. Much of this class of work has been neglected

by the dentists, and if the dentists neglect it, what are you going to expect from the parents who know nothing about the consequences of such neglect? Very few men who allow the deciduous teeth to go beyond repair would think of allowing the permanent teeth to get anywhere near that condition. If I have not brought out the fact and impressed it on your minds that any deviation from normal in the young child is a progressive, persistent, and far-reaching impediment to the growth and development of the child, then I have failed utterly in this paper. To elaborate on this phase of dentistry let us take the child at the age of three or four years with the twenty deciduous teeth in normal occlusion; by visits to the dentist every two or three months, these teeth are carefully watched, cleaned, and any small cavities immediately filled, and in addition to the treatments at the dental office the dentist instructs the parent on the proper care of that child's teeth. Does it not seem possible that by these methods the deciduous teeth may be kept until it is time for the permanent successors to take their place? We, as dentists, must give the necessary time to this part of dentistry and of course should be paid for it as for other dental work, and the small expense inflicted on the parent for this preventive orthodontia is nothing compared to the disastrous results arising from neglect of properly caring for the deciduous teeth.

In order to bring out the contrast better, let us take a child at three or four years of age with normal occlusion and teeth free from decay and give that child no dental treatment until perhaps eight or nine years of age. The child has had the usual child's share of sweets and has used the toothbrush at irregular intervals. In the majority of these cases, conservatively speaking, at least four of the eight deciduous molars have decayed far enough to destroy the pulps and to abscess, and probably the crowns of these four teeth have also disappeared as a result of decay. You all know the effects of the abscesses draining into the child's system; but perhaps you do not all know the effect of not having these teeth retaining the spaces which they should keep in order to prevent malocclusion. It is clear that without the normal tooth in position there is bound to be a contraction where the tooth was lost or destroyed and there is also a drifting of the teeth approximating the spaces. If the second deciduous molar is lost at the age of seven years, then the first permanent molar has four or five years to drift forward and cover the place where the second premolar is to come through. If the deciduous canine is lost at about the age of eight or nine years, then all the teeth posterior to the lost tooth have a fine opportunity to drift forward, and not only is the space for the permanent canine closed up, but abnormal occlusion with the teeth in the opposing jaw is also established. Many more cases of a parallel nature could be sighted, but I think these will be sufficient to bring out the important orthodontic reasons for children's dentistry. Too long retention of the deciduous teeth is perhaps less common, but exists, and in many cases where it does occur, the permanent tooth erupts in an abnormal position when half a minute's work and a pair of forceps would have eliminated all the trouble.

To be sure, in many cases the parents are the neglectful ones, but usually a little education is sufficient to make them see the necessity for this class of work, and then it is up to the dentist to put in the time and care necessary. It takes times and requires a close following up of each patient to see that the work does not get ahead of us, because the changes occurring in a child's mouth are rapid. If you and I do not feel that we can give the time to this important branch of dentistry, then it is up to us to send the children to some one who does have the time to do it. When the parents have been educated to the point that they know what is best for their children, then the demand will produce the means for accomplishing it. You who are practicing general dentistry have the opportunity, while you are working for parents to educate them along these lines, and the services you are thereby rendering are doubled, if not in fees, at least in the satisfaction that you are helping to make a better and a healthier generation in the future.

EDUCATIONAL PRINCIPLES IN PUBLIC DENTAL HEALTH INSTRUCTION

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FOR too long a time dentistry has not gained its rightful appreciation or rendered its most effective service because of its accursed empiricism, complacency, and dilatory educational methods. For the most part, dentists have been content to let a few enthusiastic pioneers take the lead, and the larger number of the group has deigned to follow, usually without rhyme or reason. We have accepted as facts many untruths in theory, teaching and practice; we have done worse, having too often approved unscientific methods and information as facts. Those methods and facts have been given to an innocent, ignorant public who believed in and regarded us as professional men, whose very position is respected and licensed by the commonwealths, because we profess to assume the position of teachers, practitioners, and leaders in one of the branches of the healing art. Before one may presume to teach, certainly he is expected to know what to teach and how to teach. It is my sincere opinion that the average dentist upon whose shoulders the ultimate service, success, and progressive usefulness of our great profession must ever rest, not only does not know *what* to teach, but, what is far more calamitous, he is not particularly anxious to concern himself or help with *how* to teach.

The dental profession, past and present, has condemned the public for not availing itself of the health services it offers. We have been jealous of allied groups who have presumed to assist us with our job. We have said that the school superintendents and teachers were not cooperative; that the normal schools and colleges had not given due consideration to mouth hygiene; that the economic conditions of the people actually prevented their obtaining dental care. In some instances, this has all been true, but may I call to your attention this fact—that this same public, which we sincerely strive to serve, continues to patronize abundantly many of our competitors, and yearly we see an increased patronage, appreciation, and happiness derived from the products of the automobile and electrical manufacturers, the clothing and furniture merchants, the confectioners, the beauticians, the beverage business, the tobacco, radio and movie magnates. Can it be people want these things more than health, good looks, comfort, and efficient lives which dentistry can and does offer? The answer lies in the educational methods, their appeal.

Many dentists have tried and desponded of teaching the patient in the dental chair. We have been misunderstood by our civic groups, and the school children have not been impressed or helped by the semiannual "interesting-to-him talk" delivered by the dentist. Nearly every excuse or alibi we might offer can be satisfactorily met with the answer that "We have not taught the

people as we should and can, nor have we correlated the best teaching with our daily practice in the office. We certainly need to encourage and assist every organization or individual attempting to help us teach the people—the organized agencies, the trained nurse, the intelligently informed parent, the physician, the hygienist, the child, and the teacher. If you as a dentist cannot become a health teacher, you can become a good citizen, interest your community in its health preservation, form active health education committees in your local, district, or state dental society groups. Either you must do the work in your office when children and adults are encouraged to come to you or you must send them to others who can and will serve them if you do not care to carry out what should be done by a doctor of dental surgery.

Not so many years ago everybody drank from the common dipper, used the washroom roller towel, believed that defective deciduous teeth were unimportant and, like infectious and contagious diseases, something children had to have. Thousands of people died of typhoid fever and mouth sepsis; the health officer's job was to inspect back yards and alleys for garbage and dead animals, to order chloride of calcium scattered hither and yon. Flies were found in every dining room and kitchen; no one thought of Vincent's infection or pyorrhea in osculation, and the baby's birth was registered only in the family Bible. Seldom was a bath taken except on Saturday night, and those who were sewed in for the winter made it an event which forecast—"Spring hath come." We believed "for every child a tooth" and that "a clean tooth never decays." Asafetida was worn around the neck to prevent smallpox and diphtheria. Consumption, or tuberculosis, was an incurable disease, and people who had it were advised to drink a great deal of whiskey or to go West, or to do both. The family doctor did everything for his patients from pulling teeth to delivering babies. There were no specialists; and epidemics and aching teeth were "a visitation from the Lord." Surely times have changed for the better too. We are amused at this review of history, and yet all of it is fresh in the memory of each of you. As times have changed, we too must change. We must inform and prepare ourselves in order to serve acceptably and intelligently this day and generation. The knowledge that things are wrong and are getting worse, without understanding why they are wrong and not having the facts about conditions to deal with, is a situation far harder to face than having the true details of a problem before you no matter how bad they are. We all know how disastrous uncertainty can be in our personal life. When facts are faced, one can deal with them when guesswork, negligence, and failure to do one's part is admitted and corrected.

Diocles, Greek hygienist, in the fourth century B.C., lived, practiced medicine, and wrote in Athens, where he was so greatly esteemed that the Athenians spoke of him as the second Hippocrates. He wrote a great work on hygiene, of which a large number of extremely interesting fragments have escaped destruction. He told us how to spend the day hygienically. "You should get up before sunrise, wash your face and hair, clean your teeth, massage your gums with powdered peppermint, and rub down the whole body with oil. Then you should take a short walk before beginning the daily work.

In the course of the morning you should pay a visit to the gymnasium for bodily exercises. Thirst should be quenched with water before eating. After the meal drink a little wine diluted with water and sweetened with honey.'' It is not what this great man told his people to do that interests me, but it is the fact that since 400 B.C. we have been telling people what to do. Few of our profession are ready to admit we have succeeded in our quest, and the thinking man begins to understand where we might have failed. Is this not a splendid starting point to take a bird's-eye view of this great field of our past experiences, present knowledge, and future hopes and possibilities? We need to face up to truth, to actual workable methods. Every member of the profession has an individual responsibility which cannot be served by any other member if it is honestly said of us that we are leaders and professional men, serving our day and making life sweet and worth while for our fellowmen. The dentist is handicapped because in his undergraduate days he was not given courses either in education or in health teaching. That man is smartest who knows where to get his information and then proceeds to make that knowledge his very own.

Merely to go into our communities and attempt to handle or correct the present dental needs without any serious endeavor to educate the child and through the child the parent—is absolutely unsound, hurtful, and wrong. Such a dental program only relieves the community temporarily and trains for pauperism. A sound, well-planned dental program will show the people that it is their duty to take care of their health and that each local dentist is capable and willing to assist them. Much too often we have become confused in our efforts to promote a dental program. Many have felt that the program is only for the indigent patient or child. This is most assuredly wrong because our program should be for all the people. The indigent patient is not justly the responsibility of the dentist. The indigent patient is the product of society; therefore society is directly responsible for his welfare and should pay for such dental care as he may need, out of the general tax fund. The same economic laws govern and affect dentistry and dental service that govern and affect any other business or activity in the commercial world. The dental profession has only health service to offer; just as an industry may have shoes, groceries, automobiles, or some other commodity. No hard and fast rule or program will fit all needs or communities, but a few basic suggestions will help. Surely we agree that it is our duty to work unceasingly for the elimination of the necessity for our profession, by helping people to prevent dental ills and their resultant sequelae. Prevention and education are our only hopes, prevention beginning with the grandparents and education with the young child.

Frankly, what are we hoping to do in our educational program? We have tried to tell children and adults what to do, and also what not to do. We have told of the inevitable bad results sure to follow neglect. We have used technical terms not understood nor appreciated. We have tried to teach dental health education as a separate and distinct subject, apart from all other phases of education—we have succeeded in our efforts in this endeavor

all too well. If we are really to succeed in our efforts, we must first of all realize that dental health education or mouth hygiene must definitely be considered a part of health education and that health education is a part of general education. Health education aims at the formation of habits of behavior—most of which pertain to the individual's life out of school, habits of eating, sleeping, clothing, bathing, exercise, ventilation, and emotional reaction. Therefore the school with its myriad obligations meets many difficulties in its efforts to insure the actual formation of the correct habits and right attitudes at which it aims. In dental health education or mouth hygiene our object is to raise the level of intelligence concerning mouth health, the evil effects of mouth infection, the necessity for its removal, the value and economy of *prevention.* Surely we must recognize the fact that the most effective place for any educational work is with children. The best agency through which we reach children is the teacher because:

1. She is trained to work with children.
2. She spends all her time on a small group.
3. She has daily contact with each child.
4. She is concerned with the child's all-round development.
5. She enjoys a closer relationship to the child than do other school workers.
6. She has educational facilities which the occasional visitor does not have, and she understands better the mental ability of children of different ages.
7. She is the one person most closely in touch with modern trends in health education.

I have tried to be honest, frank, and helpful in this paper. I have taken the subject seriously as I do our responsibility to our task. We all know there has been too great a difference between preaching and practice. Our dental health workers and teachers have taught children and parents some facts and truths, and the dentist has failed to back up and indorse these truths when the patient comes to his office. We boast of our children, but we shamefully neglect and deny them adequate and proper dental service. Frankly, have we not been more interested in making money, building practice, and getting patients than we have in promoting a dental health program?

That we have made progress as a profession no one can refute, but in some respects we need to go forward, or we shall certainly slip backward in failure and despair. Dentists need to know that education is a continuous process, that health education is like all other education. The whole child has to be considered as a self. We are not building habits and traits but we are helping each self to build itself better, and to build enthusiastically so that he sees, feels, and understands not only *what to do* but *why.* We must obey the laws of education in teaching mouth hygiene. Educators agree that health instruction in the grade schools should be taught through situations as they arise during the day, not just a set presentation. If our health program is built on the philosophy that health is a way of living, we cannot depend on one teacher, one period. The dentist and his efforts at teaching

have not been better received and utilized because in most instances the material and method were not educationally sound. As long as dentists see one objective—one aim—and fail to see the child as a whole, our efforts are doomed to failure. The health program is to raise the child's level of living twenty-five years hence.

There have been many objections to the dental health program in the schools: (1) the lack of educational procedure of the inspector, who is not in tune with the school system; (2) it is something new; (3) it costs money; (4) it is outside of school routine; (5) politics—afraid of prejudices among dentists, physicians, and public opinion; (6) difficulty of showing positive results; (7) fear of socialistic dentistry.

Many of these objections can be and are overcome as dentists and trained school health workers become better informed and prepare themselves to teach and to assist the teacher and the child. For better dental health and prevention of mouth diseases, we look to our grade schools to solve the problem. Health progress must always depend upon an informed public opinion—this public which has been approached through the kindergartens and schools. Some of the most successful teaching in the health field will be that in which young people do not think in terms of health but in terms of activity, not in terms of health habits and practices but in terms of keeping fit. Learning comes through using information rather than acquiring information, for we have found that health creeds and rules do not make habits.

Almost every effort to start a health educational program begins and usually ends with an examination which really is an inspection. The health examinations must be made more of an educational procedure. Why do we make examinations, what information are we seeking, what do we propose to do with such information, to whom shall we give this information? The health program often languishes and dies because we cannot or do not answer these questions. Surely our purpose must be more than merely to tell and retell defects, we should keep in mind the stimulation of interest of the child in himself, to determine good as well as weak points, to advise parents of defects, and to help make clear to the teacher and parent the program best suited to the child. This calls for more than a casual inspection and a notice sent home. One of the great needs of our profession is scientific, accurate, standardized data or information collected by those who do care, on a dental examination chart which will furnish really helpful, useful information of many facts we have quoted but never investigated or proved. We need better legislation, but we cannot expect legislation unless we precede this by education. Dental health progress depends upon an informed public opinion; we all agree that the public is best approached through the schools and allied groups.

Now the question arises, since the dental profession has been criticized because of its dental health material and information, how shall we know what is scientifically true and educationally acceptable since truth is demanded? We shall have to follow these general rules. Is it true: (1) experimentally, (2) clinically, (3) physiologically. We should be especially

critical of fads, fancies, and advertising materials lest we use something planned chiefly for the purpose of selling a certain product. Some advertising material is educationally and scientifically sound; much of it is not. Either dentists must become educators and teachers not just in word but know the principles of teaching, selection of proper material and intelligence levels of the groups taught, or they must present the teacher with material, cooperation, and assistance so she can interpret the dentist's knowledge to the child. Dentists have failed in their presentation of material in the past, largely because they did not know or understand certain fundamental standards for selecting materials or properly presenting the materials. There are certain educational and mechanical standards commonly used for judging all teaching materials. There are, in addition, special evaluations which should be particularly applied to materials to be used for teaching health. Certainly one should ask one's self the following questions when choosing a piece of health educational material:

1. Does the material contain accurate information? No information should be given to a child until the scientific accuracy is established.

2. Who is the author of the material? Has he the background for writing it? What is the object in writing it? Does it tend to overemphasize one phase of mouth hygiene or the use of a certain product?

3. Is it in accord with modern good educational theory and practice?

4. Is it well motivated? Is the motivation sound? That is, is it placed within the subject itself? Is it likely to function productively in adult life? Motivation by giving rewards is unsound if judged by these two standards.

5. Is it suited to the intelligence level and related to the common experiences of the children with whom it is used?

6. Does it have literary (or artistic) merit?

7. Is it positive? Does it provide for derivation of satisfaction from the right conduct rather than from dissatisfaction with the wrong? Does it respect the child's wish for security by avoiding use of the fear element, a negative procedure?

8. Does it provide for situations or activities in which the child may learn by doing?

9. Does it provide satisfaction in any way for things the children have done?

10. Do the activities presented lead the children to larger fields of activity?

11. Does it provide for a use of materials at hand and as they occur in life?

12. Is it real? Since the goal of health teaching is to establish desirable habits and attitudes, experiences and situations based upon reality should be used rather than fantasies or dreams. The latter may entertain but do not suggest adventures into which the child may enter vicariously and which he can translate into his own health behavior.

When we apply these rules of evaluation, we immediately conclude that there is very little good dental health material available. True, there is a vast amount of material if one will but take time to assemble and utilize it, and create the situations through which we strive to teach dental health.

This is very important. Remember that we are striving to interest and stimulate not what to do, but why and how to do, until it all becomes a helpful part of each one's best self. Bernard Shaw has remarked. "It is said if you wash a cat it will never again wash itself. That may or may not be true, but what is certain is, that if you teach a man anything, he will never learn it." So we can see we have not succeeded better with our task of dental health instruction because we disregarded fundamental educational principles.

Since "human progress marches only when children excel their parents," will you not here and now pledge yourself:

1. To instruct children and youth so that they may conserve and improve their own health.

2. To establish in them the habits and principles of living which throughout their school life and in later years will assure that abundant vigor and vitality which provide the basis for the greatest possible happiness and service in personal, family, and community life.

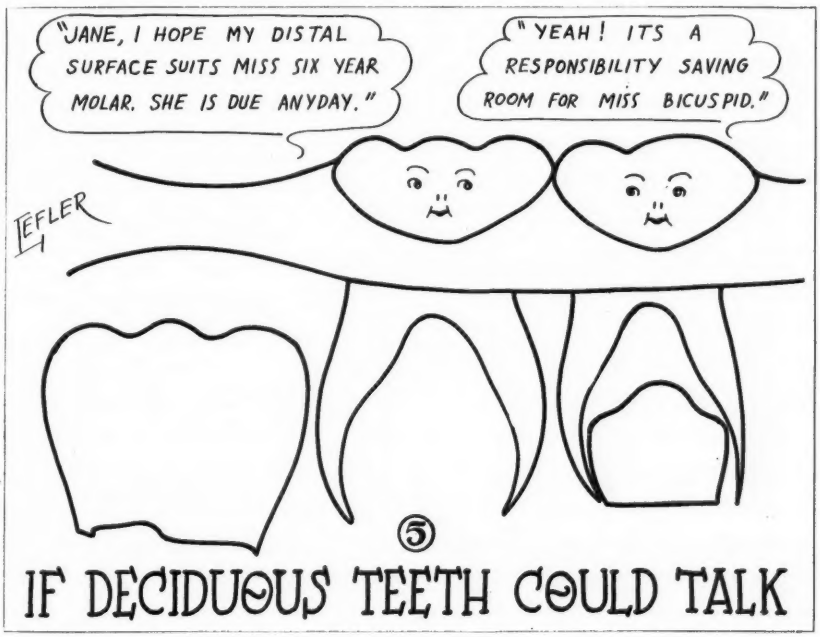
3. To influence parents and other adults, through the health education program for children, to better habits and attitudes, so that the school may become an effective agency for the promotion of the social aspects of health education in the family and community as well as in the school itself.

4. To improve the individual and community life of the future; to insure a better second generation, and a still better third generation; a healthier and fitter nation and race.

IF DECIDUOUS TEETH COULD TALK

HARRY B. SHAFER, D.D.S., ANNA, ILL.

PEDODONTISTS have been accused of simply placing fillings and giving very little thought to the teeth and to the face as a whole. The distal surfaces of the second deciduous molars should be carefully examined for caries, and fillings



with smooth margins should be placed so that the first permanent molars will receive a royal welcome and can assume their positions with safety.

Distoclusal fillings in first deciduous molars are considered difficult restorations. They may, however, become attractive operations (not drudgery) if the dentist remembers that perhaps he is maintaining space for a premolar and is thereby avoiding orthodontic intervention.

THE CHILDREN OF AMERICA CHALLENGE THE DENTAL PROFESSION*

THOMAS A. GARDNER, B.A., D.D.S., OMAHA, NEB.
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THE nation-wide dental survey of ten million school children which has just been completed under the sponsorship of the United States Public Health Service, marks the beginning of a new deal in dentistry for the children of America. The advance statistics of the survey suggest that the condition of the mouths of our children is but little different from that found to have existed some twenty-five years ago when the profession's interest was first aroused in the examination of school children. This situation in view of the progresses which have been made in other phases of dentistry is indeed both inconsistent and deplorable. In Omaha, the survey of 5,000 children disclosed the following information:

85.4 per cent are in need of dental attention,
52 per cent have had some form of dental service, such as prophylaxis, extractions, or fillings,
48 per cent have had no dental service whatsoever.

It may be safely said in view of the dental survey that throughout our country the practice of preventive dentistry for children is almost unknown from the standpoint of application. This applies equally to the laity and to the profession. Indeed, the term "preventive dentistry" is a bit far-fetched in this connection. We should say instead that even everyday practical dentistry for children is almost an unknown thing. The millions of mouths of school children which were examined and had had or had not had dental attention are living testimonials of evidence and condemnation. Our profession can no longer beg the issue or maintain that conditions are not so black as pictured. The facts are before us, of which there can be no denial.

The dental profession has improved tremendously in surgical and mechanical technics, as well as in knowledge of focal infection and the rôle of foods as related to the human body. We have promoted propaganda to the layman in many ways. But the tragedy of it all is that in most cases the progress has been largely of greatest benefit to the adult. There is no doubt that much good has been accomplished, but we have begun at the big end of the log and are not securing results proportionate to the time, energy, and money expended. Adults are difficult to educate into new ways, and besides most adult mouths are beyond real preventive opportunities. Consequently, our practices largely consist of extractions, partial plates, bridges, crowns, full dentures, all of which is a far cry from prevention. Many of the extensive types of restoration necessary in adult mouths are preventable if educational measures are initiated early in life—prenatal, infancy, and childhood.

*Delivered before the Nebraska State Dental Society, May 20, 1934.

Dental disease is essentially a disease of childhood and youth. It changes from the acute to the chronic types of decay between twenty and thirty years of age according to Bödecker. It appears most logical that if a child's mouth can be inspected and kept in a good condition every six months from two or three years of age until he is an adult, granting proper diet and mouth hygiene, there are excellent chances, economic conditions permitting, that he will not only continue to maintain the health of his mouth but in turn upon becoming a parent, will make an effort to care for his children's teeth. This outlines for us the shortest possible route to practical preventive dentistry for the adult of tomorrow. Such must and can come only through the child. The public school system offers an ideal channel for the promotion of such a program of dental health education. It is up to the profession to see that an effective plan is developed and adopted. In Iowa a well-accepted program of this character reaches more than 75 per cent of the elementary school children of the state.

Today, most students of the diseases of children recognize that infected teeth in the mouths of children lower the systemic resistance to all forms of disease. Temporary or permanent organic and systemic injuries often result. Diseased teeth may thus be secondarily responsible for some of our school failures, school absences, and problems of discipline by virtue of impaired health. Early loss of deciduous teeth is an important factor in malocclusion, improper development of the jaws and other facial bones, causing mutilations of the features of children's faces, and interfering with other vital physiologic processes.

In my own practice, I have seen many cases in which abscessed deciduous teeth were positive factors affecting the health and behavior of children. Only several weeks ago a mother of one of my five-year-old patients exclaimed that her child was an entirely different person since having had her teeth cared for. Previously she had been nervous and had lost her appetite. This same type of history could be repeated for many other cases. The child referred to had two abscessed teeth and three pulp exposures, among her eight deciduous molars. Cervical adenitis was present. The abscessed teeth were extracted, pulp amputations performed on the teeth which had exposures, and space maintainers were applied to hold the teeth in their normal positions. It would not be difficult to picture the future of this child's mouth and health had the mother followed another dentist's advice, "that the teeth are only baby teeth," and then proceeded merely to paint them with silver nitrate. This treatment was offered for a mouth containing teeth which were definitely pouring infection into the child's blood stream, perhaps as much infection as might come from diseased tonsils. This was offered for teeth that should normally have lasted this child for seven additional years of usefulness. No dentist would propose such treatment for an adult mouth in hope of saving it from destruction during a period of seven years. This particular example of negligence and advice to parents is but a sample of what transpires daily in thousands of dental offices throughout the country. Why do we fail to recognize the importance of adequately caring for the deciduous teeth?

Several reasons are offered in answer to this question. In discussing this situation I do not want to give the impression of being disloyal to my profession. However, if we are to progress, we must be willing to admit our deficiencies and doubly willing to correct them. Aside from inertia, carelessness, and insincerity, there are other and more vital reasons why the general practitioner so often falls down on the job of giving adequate dental care to the child patient. Most dentists, both the recent and the older graduates, have not been taught the importance of and the technic for caring for the child patient while they were dental students. Even today there are some class A dental schools that do not give proper instruction and clinical training for the child patient. I offer this as the chief reason for the dental neglect of America's children. On the other hand, if the dental student is trained in the possibilities and fundamentals of children's dentistry, I believe that in most instances when he goes out to practice his child patients will be properly cared for, at the least far better than most of them are cared for today. There is nothing mysterious about the handling of children, nor is the work for them unusually difficult. All dental students should be thoroughly taught the fundamentals of children's dentistry.

A problem of economics also enters into consideration. Dentists find it difficult to charge a fee comparable to fees collected for similar services rendered for the adult patient, even though sometimes the operation may have required more time and nervous energy. Our profession is largely responsible for this situation. Up to the present time dentists have extracted and filled deciduous teeth for no fee whatsoever or for extremely low fees and often with the comment, "Well, these are just baby teeth." *Only when we ourselves come to realize the great value of deciduous teeth to the normal development and health of the child will we be in a position to convince parents that the most painstaking and careful work must be done on these teeth and that it is worth the fee for that type of service.* This is the answer to the economic problem of dentistry for children. Improvement in such fees is thus entirely up to the dentist. The education of the parents as they bring the child to the dentist is the solution.

Problems of child management and temperaments incompatible with children probably are also factors preventing proper care of many child patients. Whatever the causes for failing to proceed with the proper treatment, no dentist for any reason should ever be guilty of making false statements to parents relative to the care of children's teeth. If a dentist does not care to work on children, he should be ethical and self-respecting enough to tell the parents the truth rather than to permit their mouths and health to be jeopardized. I firmly believe, however, that if dentists will conscientiously study the problems of children's dentistry, securing a good textbook upon the subject, and envision the infinite amount of good which they are contributing to the normal development and physical welfare of their children patients, there are very few dentists but who could perform almost any necessary operation upon almost any child patient.

Before concluding this paper it is well to make several further observations relative to abscessed deciduous teeth or teeth with so-called gum boils. This is a condition the seriousness of which is rarely appreciated. Dentists recommend the prompt extraction of such teeth in the mouths of adults, but for the mouths of children it is a different story. These teeth must be retained for the purpose of maintaining the space for the unerupted permanent tooth regardless of their state of putrefaction and decay. The health of the child, the possibility of focal infection—arthritis, cardiac involvement, and lowered general resistance to disease—are not considered. The objective is purely one of mechanics. Dentists frequently state that so long as an abscessed tooth is draining there is no danger to the patient. The fact remains that such teeth may be the source of the above mentioned systemic disturbances, that they are the cause of much tonsillar infection, and that they often infect the salivary glands. Dr. Knode of Omaha, a nose and throat specialist, states, "One cannot overstress the definite relationship of abscessed deciduous teeth to the infection of the glands of the neck and throat and the tonsils." In our office such teeth are unquestionably recommended for extraction and space maintainers advised.

Ten million school children hold in their hands an indictment charging the dental profession with negligence and incompetency in the care of their teeth. What is the profession going to do about it? Is it to rise and meet the challenge, giving the children of America a fair square deal in mouth health or is it to lapse back into happy-go-lucky ways and permit conditions during the next twenty-five years to be as we have found them during the past quarter of a century?

The profession can solve the problem in three ways: First, insist that the dental colleges adequately train the dental student in children's dentistry. Second, every dentist should endeavor to increase and perfect his knowledge and technical ability in children's dentistry. Third, insure that a program of dental health education is inaugurated for the school child.

COPPER AMALGAM—HIGH SILVER AMALGAM*

C. Wilford Wilson, D.D.S., Detroit, Mich.

THIS investigation of copper amalgam and high silver amalgam was undertaken because of the wide differences in opinion as to which of the two was the better suited for filling material in children's teeth. The literature in the A. D. A. library and the Bureau of Standards has been thoroughly searched, all information possible has been obtained from the manufacturers,† and men‡ who are considered authorities in metallurgy and research have contributed their knowledge and information. The following information is given for whatever practical application it may have in the practice of children's dentistry today.

In searching the literature and attempting to obtain information on the subject, the outstanding facts developed are in the replies received from the A. D. A. and the Bureau of Standards in Washington. The Bureau of Standards replied as follows: "There is very little information in the references available on copper amalgam. Item No. 13 gives some data on this material." These data were thoroughly gone over and will be given later. The A. D. A. replied as follows: "Practically nothing is now being published in the dental literature on the subject of copper amalgam. Before 1900 there were many articles on this subject, but, unfortunately, the Library Bureau has only a limited number of them; however, these clippings will familiarize you with the main characterization of copper amalgam." These facts will be given later.

We all know the recent work[1] that has been done on high silver amalgams and the results that have been obtained. Specifications number 356, and the subsequent bulletins issued cover this material thoroughly. It is of passing interest though to note the pledge that was signed by all members of the American Society of Dental Surgeons in 1845. The signing of the following pledge was compulsory, or expulsion from the Society was automatic: "*Resolved,* That any member of this Society who shall hereafter refuse to sign a certificate pledging not to use any amalgam and, moreover, protesting against its use under any circumstances in dental practice, shall be expelled from this Society." Thus we can trace the development of amalgam from that time to the development of specification number 356. These specifications and subsequent bulletins are our guiding post of today for high silver amalgam, and the conscientious operator today will use only high silver alloys that come up to those qualifications.

*From the Section on Children's Dentistry, the Detroit Clinic Club.

†Cleveland Dental Co.; W. V-B Ames Co.; Minnimax Co.; L. D. Caulk Co.; Garhart Dental Specialty Co.; The S.S. White Mfg. Co.

‡Dr. C. L. Drain, State University of Iowa; Dr. M. L. Ward and Dr. U. G. Rickert, University of Michigan; Dr. A. L. Black and Dr. K. W. Ray, Northwestern University.

The first information available on copper amalgam is taken from the *Dental Cosmos* of January, 1891. The material was denounced by some, while others claimed it to be superior to any other material. Tests proved it worthless and tests proved it perfect. The opposing claims were as follows: "No antiseptic properties, soluble in certain mouths, detached particles discolored other teeth, danger of absorption, subject to shrinkage allowing moisture to permeate the tubules, and tendency to soften at the cervical." The arguments in favor of its use were as follows: "Leakage was present only where packed too soft or too wet; discoloration resulted from three causes (1) defective manipulation, (2) in teeth of poor structure which were permeable to water resulting in oxidation which is beneficial as it hardens the tooth, (3) impure preparation." They advocated covering the copper amalgam with gold or silver and stated that they never found cervical softening where the saliva was alkaline. The opinion of the majority at that time was that it was indicated in cavities on the buccal surface, in large approximal cavities that extended under the gum line, and in cavities that were beyond the reach of the toothbrush. The manipulation was as follows: "Heat slightly and grind vigorously, the more the better, squeeze until the consistency of putty, and insert a small piece at a time. In combination fillings the copper amalgams must set thoroughly first or the filling will be porous. If the cavity is filled dry, decay will continue, if filled wet, decay will stop."

The next information is from the *Dental Cosmos* of 1893. The opinion as expressed at that time is as follows: "The many and almost universally dissentious writings about copper amalgam indicate that the majority of those who ever used it have now discarded it, and by the time they have finished repairing the last copper amalgam filling that has cupped they will have to enlarge their vocabulary or they will be unable to express themselves. Copper amalgam as a filling material used alone without a covering of gold or silver is of no value."

There is no further material available until 1926. At that time we find the following data in Ward's American Text: "Copper amalgam differs so markedly from all other amalgams, in both composition and behavior, that it deserves separate consideration. It is an alloy of copper and mercury and can be made by adding freshly precipitated and washed metallic copper to an excess of mercury until the solution is complete. A far better method is the electrolytic method, and copper made by this method changes very little in volume if at all. It is antiseptic. These two qualities make one of the best tooth preservers now in use, although it has other qualities so undesirable as to exclude its use in a great majority of cases. It turns almost black in the mouth, has a peculiar metallic taste, is sometimes a marked cause of voltaic disturbance, and recent observation indicates that this material either shrinks or cannot be packed on account of its springy nature."

It must be borne in mind at this point that all information given up to this time is merely expression of opinion, not of scientific nature. This applies to both copper amalgam and the silver alloys, as we know now that the instruments that were available previous to 1928 were neither scientific nor standard in the hands of different men. The data that follow are of a scientific nature

and can be relied upon because of the standardization of instruments and technics for testing.

The only data available during 1927 and 1928 are summed up as follows: "With copper amalgam it is almost impossible to build permanent contact points in deciduous teeth."

The following data were published in 1929, taken from "A report to the Research Commission of the American Dental Association (a survey of amalgam alloy)": "Three copper amalgams were analyzed with the following results as compared to an alloy satisfactory under specifications No. 356."

CONSTRUCTION TO 1ST. MINIM. MICRONS PER CM.	TOTAL CHANGE 24 HOURS OR PARTS PER	FLOW PER CENT 250 KG. 10 PER SQ. CM.	CRUSHING STRENGTH LB. PER SQ. IN.
Alloy –0.5	–3.5	2.8	54,500
Copper (Ave. of 3) –1.5 to –6.0	–1.5 to –6	0.1	38,000 to 48,000

Copper amalgams were further classed unsatisfactory with specifications No. 356 because the setting changes alone were unsatisfactory. Chemical composition was not determined. Further conclusions were as follows: "Copper amalgam shows a continuous shrinkage for a period of twenty-four hours; although the total change is less than in many of the unsatisfactory high silver alloys. Their flow values are satisfactory. The crushing strength values are fairly high but erratic, owing, perhaps, to difficulty in heating the material uniformly in amalgamating it according to the directions furnished. The edges clip easily and the alloys do not machine well. The manipulatory methods used in handling are such that it is very difficult to produce two specimens having the same or nearly the same physical properties. We may therefore expect a wide range of variations in strength, setting time, and other characteristics in our finished products."

The foregoing statements are all taken from the dental literature and give the consensus of opinion on copper amalgam from 1891 to 1929. These statements show that copper amalgam was highly thought of when first introduced and went through the same line of thought as high silver, but the difference lies in the fact that the scientific requirements for high silver were finally standardized and approved, whereas copper amalgam up to this time has lost practically all the scientific support that it had at the beginning, and cannot be compared to any of the high silver amalgams that do meet specifications No. 356.

I have made every attempt to secure whatever data are available as to work being done at the present time. As stated at the beginning, questionnaires were sent to the leading manufacturers and authorities of the present day, and the following conclusions are drawn:

(1) With the possible exception of one reply, the statement was made that copper amalgams do shrink and at no time show an expansion. I studied the graphs of Dr. Coggan of the University of Michigan, and they show that there is no expansion at any time and the shrinkage varies from 5 to as high as

14 microns. This shrinkage has stopped all further consideration of copper amalgams at the Bureau of Standards. (Dr. Kenneth Easlick, University of Michigan.)

(2) The black deposits that form on copper amalgam fillings are a combination of cuprous and cupric oxide. This material is highly antiseptic and is the activating agent that is beneficial. This antiseptic action can only be obtained though in a cavity that *leaks,* and a copper amalgam filling or any other that does not leak has no antiseptic value. These antiseptic properties have in the past seemed advisable, but are they in the light of present-day findings which indicate that copper amalgam in producing cupric oxide, produces what is considered by some authorities at the present time an almost perfect embalmer? They claim that the action of this material is almost the same as that of arsenic only much slower. They believe that it will cause the painless death of the pulp. Traces of cupric oxide can be found in the pulp chamber underneath a copper filling. (Dr. M. L. Ward, University of Michigan.) It has never been proved as stated by some writers that it can be placed closer to the pulp of the teeth than any other filling material. (Dr. U. G. Rickert, University of Michigan.) It may not irritate and cause pain as some other materials do, but as stated before in many cases it may cause the painless death of the pulp. A particle of silver can be inserted underneath the skin of a dog and the tissue will tolerate it, but a piece of copper so placed will cause a reaction of some type that is radiopaque. It is not known definitely at this time what this reaction is, but it is visible under the x-ray examination. (Dr. Dixon, University of Michigan.)

(3) The procedure in chronic cases at the University of Michigan Dental Clinic today is as follows: First, remove all black fillings; second, remove all gold crowns; third, remove all large metallic fillings. This is done because of the belief that it is not the dead tooth that is causing all the trouble but is more liable to be the dying tooth. In many cases the treatment of a tooth of this type will remove the trouble. Some of the foremost thinkers of today are insisting that all fillings be lined for this reason. We know that copper amalgam does penetrate the tubules and the pulp chamber and may cause the painless death of the pulp. To prevent this we should line the cavities, but if we line them we lose the antiseptic action that we are after, therefore why use it?

The above conclusions, in the light of our past belief in regard to children's work may seem incredible, but it may be that copper amalgam is causing the death of many teeth that have abscessed under small fillings because we do not see the tooth until the abscesses are developed. Investigators believe today that a great many of the pulps under these fillings are devital, but we get very few chronic cases in children. They are not detected. Would this not be possible in the case of a painless devitalization?

All copper amalgam fillings will cup; it is impossible to maintain a contact point; the edges are brittle; it cannot be packed but has to be used more as a paste; it has decided shrinkage with no expansion; it may painlessly devitalize; all fillings today should be lined; black fillings today are the first to be

removed in chronic cases in adults. Tissue will not tolerate copper; it has a definite voltaic characteristic. Should it be used routinely in children's practice?

This question was asked of Dean M. L. Ward of the Dental School of the University of Michigan, and his reply was as follows: "If we want to put in a filling that leaks, not remove all decay, run the risk of a painless devitalization, not line our cavities, and have a black filling, then copper amalgam should be used. Otherwise it seems advisable at the present time to use a material that meets the standards suggested by the Bureau and adopted by the American Dental Association. This material which has been approved is one of the high silver amalgams that have been tested and found adequate. This amalgam today with a proper cavity liner seems to be the proper plastic filling material for the posterior teeth of children. I think I may say that almost no one except a few of those practicing children's dentistry use copper amalgam, for it has well-known objections from the standpoint of discoloration which is caused very largely by the shrinkage of the material." Those who practice children's dentistry and use this material have never explained a thing about it except their experience in saving teeth. The ability of copper amalgam to save teeth must be granted, for it has two qualities for this purpose, (1) it is antiseptic, and (2) it shrinks. Equally enthusiastic are those who practice children's dentistry and use a high silver amalgam either alone or with a cement lining. There is no evidence to show that one method is more effective than the other in caries prevention. In the preservation of occlusion, preservation of contact, elimination of possible death of the pulp, the evidence is practically all in favor of the high silver amalgam with cement lining.

REFERENCE

1. Ward, Marcus L., and Scott, Erman O.: Effects of Variations in Manipulation on Dimensional Changes, Crushing Strength and Flow of Amalgams.

WHAT ARE THE CAUSES OF FAILURE OF ERUPTION OF THE DECIDUOUS MOLARS?*

FLOYD ARNOLD, D.D.S., DEARBORN, MICH.

MY EXPERIENCE has been that the dental literature has nothing to offer on this subject. Most of my information came from Dr. Geo. R. Moore, who wrote a case history of partially erupted deciduous molars. I contacted no one who could give me any satisfactory explanation of the partial eruption of permanent teeth. However, the same factors may be present as with deciduous teeth.

I shall attempt to outline this information and divide the cause into two classes:

First, the remote causes:

1. The possibility of a circulatory disturbance in the region.
2. The possibility of disorder in the nervous system.
3. Lack of physiologic impulse.

Second, the proximate causes:

1. The possibility of a feebleness of maxillary or mandibular growth in the region. This may very easily be associated with lack of bone cell development.
2. The normal tendency of the first permanent molars to assume a more anterior relation due to mastication.
3. Physical force of the permanent molars causing an intrusion of the deciduous molars.

From the above outline we assume that normal bone growth has resulted on both sides of the partially erupted teeth.

In the case Dr. Moore experienced in his own practice the patient presents a history of at one time having normal occlusion of deciduous molars. Report of the case follows:

"The patient, a girl of six and one-half years, called for examination on October 27, 1928. The father and mother, and, according to their account, all relatives of whom they had any knowledge, exhibited normal dentitions with only minor irregularities, if any. The mother reported for the girl a normal prenatal period, normal birth, and normal early infancy. The child was breast fed for three months only, but the mother has been conscientious in matters of nutrition and rest, and has been careful to give her the very best of attention by placing her in the hands of a competent pediatrician. She has suffered only two of the ordinary children's diseases, measles and chickenpox, and until recently she had never been subject to colds. She presented at that time evi-

*From the Section on Children's Dentistry of the Detroit Clinic Club.

dence of hypertrophy of adenoid and tonsil tissue and was referred for a tonsillectomy and adenoidectomy, which were done within two weeks after our original consultation. The child was of a somewhat nervous temperament, possessing at that time the last evidences of a thumb-sucking habit, a lip-biting habit of some severity, and a nail-biting habit."

ATTRIBUTED ETIOLOGY

Unfortunately, my observation of the case began after the complete eruption of the permanent first molars. The mother reported that deciduous molars had once been in occlusion. I can therefore account for open-bite shown in the lateral views only very inadequately by referring to a possible circulatory or nervous disorder in that region of the developing maxilla and mandible. This might be attributed to a temporary feebleness of growth with the result that the normal tendency of the first permanent molars to assume more anterior positions in the head delivered stresses which actually caused the intrusion of the molars lying between them and the canines which were supported by more healthy bone. This is only a subjective opinion not at all sustained by scientific evidence, and I am hoping some day to hear the real cause of intrusion of deciduous molars.

ENAMEL*

PAUL LUDINGTON, D.D.S., DETROIT, MICH.

Howard Mummery, F.R.C.S., L.D.S., D.S.C., London, England.[1] "There is probably no tissue that has given rise to so many contradictory statements, so many hastily formed conclusions, as the enamel. We have been authoritatively informed that it contains no organic matter, that it is a dead tissue, uninfluenced by any body changes, serving only as a resisting barrier, to form a protecting wall for the rest of the tooth."

John A. Marshall, M.D., F.A.C.S., California.[2] "The statement has been frequently made, and quite generally accepted, that fully developed enamel, when once formed, is not susceptible to physiologic change. In other words, it has no nutritional metabolism."

The difference of opinion among research workers of the past upon this subject has been so great that they seem to be almost irreconcilable. One school has maintained that the enamel when once completely formed is a crystalline body, having not the faintest evidence of a nutritional metabolism; that when once formed it is incapable of any change, except by conditions from without, due to its external environment; while another school believes the enamel to be a tissue endowed with a certain amount of life, subject to a degree of nutritional change, showing evidence of vital resistance under attacks from disease, such as caries, and under irritation from the acids of certain mouth bacteria.

Charles F. Bodecker, D.D.S., F.A.C.D., New York.[3] "The enamel of newly erupted teeth has not attained the highest degre of calcification. Post-eruption calcification of the enamel and dentin takes place by the deposition of inorganic salts brought to these tissues by a fluid derived from the vessels of the dental pulp."

The organic matrix of the enamel is instrumental in distributing these inorganic salts. It is probable that as long as the individual remains healthy, the enamel retains its normal resistance against dental caries.

Bunting and Rickert claim that the enamel is hardened after the eruption of the tooth by a deposition of inorganic salts of the saliva. Dr. J. Leon Williams admits the post-eruption hardening of the newly erupted teeth, but does not believe that it takes place by means of either of the two theories advanced.

Bodecker and Williams coincide in the opinion that superficial areas of enamel may be hardened by the deposition of salts of the saliva.

A further corroboration of the presence of diffusional channels in the enamel of erupted teeth has been presented by Percy Howe, at a meeting of the New York State Dental Society in New York, May, 1926. A tooth of a man who

*From the Section on Children's Dentistry of the Detroit Clinic Club.

died of lead poisoning was sectioned, and these specimens were tested by treating with ammonium sulphide. Lead was found not only in the dentin but in the enamel.

R. W. Bunting and U. G. Rickert, Ann Arbor.[4] "We have checked and corroborated the statements of H. P. Pickerill, who said that the teeth when first erupted were not dense and well organized as to their enamel surfaces, but that they became condensed after coming in contact with the saliva.

"We have found that these hard, well-formed varieties of teeth which are usually associated with high calcium saliva have surfaces which are far more dense and less penetrable to silver salts than those of an inferior grade."

From all of which it seems that the enamel of a tooth, to a certain extent, is a changeable structure, and that when it is first laid down by the enamel-forming organs, it is not complete, but that certain spaces exist between the enamel rods for varying distances from the surface toward the interior. It seems very evident that the tooth undergoes a condensation after eruption. The question is, does the material for this condensation enter the tooth from the saliva on the outside; from the circulation of the pulp on the inside; or does it come from both?

"After a tooth has erupted, can any dietary influence modify the hardness of the enamel?"

In answer to this question Dr. Bunting makes the following statement:

"There is a possibility that good and poor types of diet may, through their influence on metabolism, alter the saliva so as to produce a consolidation or a retrograde change in enamel. The actual proof of the verity of this statement or the demonstration of its occurrence is exceedingly difficult, if not impossible, to obtain. Therefore, it is at the present time purely a speculative hypothesis in support of which there is no conclusive experimental or scientific evidence."

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GOOD HEALTH VIA MOUTH HYGIENE*

ANNIE TAYLOR, ATLANTA, GA.
Supervisor of Mouth Hygiene, Georgia State Board of Health

THE Division of Mouth Hygiene in the Georgia State Board of Health exists to promote the health of the people of the state by showing the evil effects of mouth infection, the necessity for its removal, and the value and economy of prevention.

There is no single road that leads to good health. No one precaution, no single remedy will enable a man to avoid all diseases, to escape all suffering. Among the aids to good health the proper care of the teeth plays an important part. Three good reasons for this influence of mouth health upon general health are:

1. Teeth are body organs with a particular task to perform. They must help the preparation of food for digestion. Neglect hinders the performance of this important task. There is a close relationship between teeth and digestion, between digestion and health.

2. Nearly all contagious diseases find entrance into the body through the nose and the mouth. A clean and healthy mouth makes it difficult for the disease organism to find lodgment.

3. Neglect of teeth can result in body infection. We are told by physicians that decayed teeth often cause diseased tonsils, enlarged glands, heart trouble, kidney diseases, and that any part of the body can be attacked by the poison from an abscessed tooth.

We must have teeth for good health and good health for good teeth. Mouth hygiene means sound and well-built teeth and healthy gums in clean mouths. This is accomplished by giving special attention to diet, by practicing certain rules of cleanliness, by early repair of defects or tooth decay found in teeth.

The four principles of mouth hygiene are: diet, exercise, cleanliness and dental care. Diet—because food influences teeth throughout life; before they have erupted it insures proper growth, and after they have erupted it preserves them. It has been conclusively shown that diet is the important factor in the building of strong teeth and in increasing their resistance to that destroyer of teeth—tooth decay. The food we eat makes for or against mouth health. Protection through diet does not demand rare, expensive foods. All that is required is an adequate supply of mineral salts, mainly calcium and phosphorus, and certain vitamins. These food elements are found in milk and other dairy products, whole wheat cereals, green leafy vegetables, and fresh fruits.

Like any other part of the body, the teeth and gums need exercise. The purpose of the teeth is to chew food, thereby preparing it for use by the body. Failure to chew food properly not only affects the digestion but directly

*A radio talk.

affects the teeth themselves. Some rough, coarse, hard foods, as raw vegetables, fruits and hard crusty breads, will exercise the teeth, strengthen the gum tissue, and aid in cleansing the teeth.

Mouth cleanliness is recognized as an important factor in reducing tooth decay. Brushing the teeth is a worthwhile habit, twice daily. Remember that no tooth paste or powder is any better than the manner in which it is used. Soda or salt or a combination of the two makes a safe and inexpensive cleanser. Choose a small, medium hard brush with well-spaced bristles of equal length. There are several approved methods of brushing teeth. A simple and effective one uses the sweeping stroke, beginning on the gums and brushing toward the cutting edge of the teeth. Dirty mouths afford the most favorable lodging place in which decay germs live, multiply, and accomplish their work of destruction.

Early dental care means prevention as well as correction. A tooth is the one part of the body that cannot repair or rebuild itself. Eliminating tooth decay in its early stages is almost as important as preventing it. Your family dentist is a specialist who is trained to recognize tooth decay at its very beginning. Regular visits to him will give him an opportunity to remove the decayed portion before it becomes extensive and to restore the tooth to its normal function. Dental decay is a destroyer. It destroys tooth structure; it destroys the function of the teeth; it destroys the beauty of the teeth and of the mouth. If allowed to progress it may affect the general health. A disease capable of such devastation should be brought under control. Give your dentist a chance to do his part by having him make an inspection of your teeth with the necessary corrections every six months. Some one has said, "Let your dentist's office be a service station rather than a repair shop!"

Perhaps the worst fallacy concerning teeth is the widespread belief that baby teeth need not be cared for or filled. This is wrong. Baby teeth are expected to serve the child until he is ten or twelve years of age. To fulfill this expectation they must be examined and cleaned regularly and treated and filled as occasion demands. Every child should have sound healthy teeth, and every child can have good teeth if we begin early enough to provide for them. The quality of deciduous teeth is determined before the child is born and the quality of permanent teeth depends in large measure upon the care of baby teeth. Few parents realize that mouth infection is a disease, and children who have decayed and abscessed teeth are sick children. Teach children to form the habit of observing the four rules of mouth hygiene.

We are told that "Health is that quality of life which enables an individual to live most and serve best." Never lose sight of the fact that dental service is health service. Dental disease may be the result of ill health elsewhere in the body or it may produce ill health in some other part.

The Board of Health wishes you to remember:

"Good teeth mean good mastication,
Good mastication means good digestion,
Good digestion means good nutrition,
Good nutrition means good health,
Good health means a strong and happy person."

Department of Orthodontic Abstracts and Reviews

Edited by

DRS. EGON NEUSTADT AND JOSEPH D. EBY, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. Egon Neustadt, 133 East Fifty-Eighth Street, New York City.

A Child's Book of the Teeth. Harrison Wader Ferguson, D.D.S. 106 pages, 125 illustrations, World Book Company, Yonkers, N. Y.

We have many books on the subject of teeth. Most of them are textbooks from college days, reluctantly hidden in a dark corner of the bookcase, ready to be consulted again in an emergency which never arises.

Sometimes a patient's curious hand grasps one, and he reads with fluttering heart and with perspiration on his brow the sinister forebodings of his

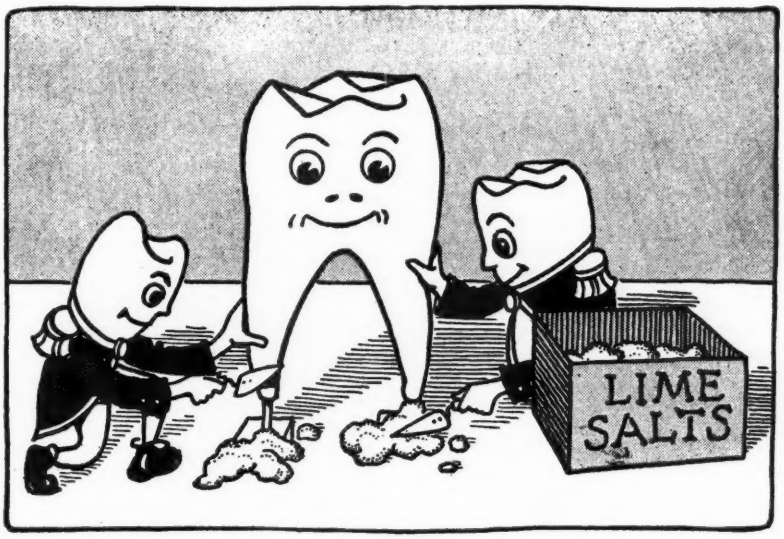

Fig. 1.*

next treatment. He stares at the formidable illustrations of pulpitis, myelitis, and Class II distoclusion. Of course, he does not understand the text because its language is too technical. If he asks the dentist for information, he finds out that not all technical language is confined to textbooks.

Ferguson's book of the teeth is a book which any one can understand. It is a concise textbook on dentistry—in simple language. It is full of exemplifications taken from our everyday life; yet every statement is essentially correct.

*Figs. 1, 2, and 3 are reproductions of illustrations used in *A Child's Book of the Teeth.*

We read what teeth are made of and how they get their building material (Fig. 1); why we need them and how they do their work; how to keep them well nourished; why they should last a lifetime; why they should be kept clean, and what tools should be used for the cleaning job; how a hole forms in a tooth; why a tooth aches (Fig. 2); what causes a gumboil; what the x-ray sees. And last, not least, we read why some teeth are crooked. This is the chapter on orthodontia. Different types of malocclusion are described

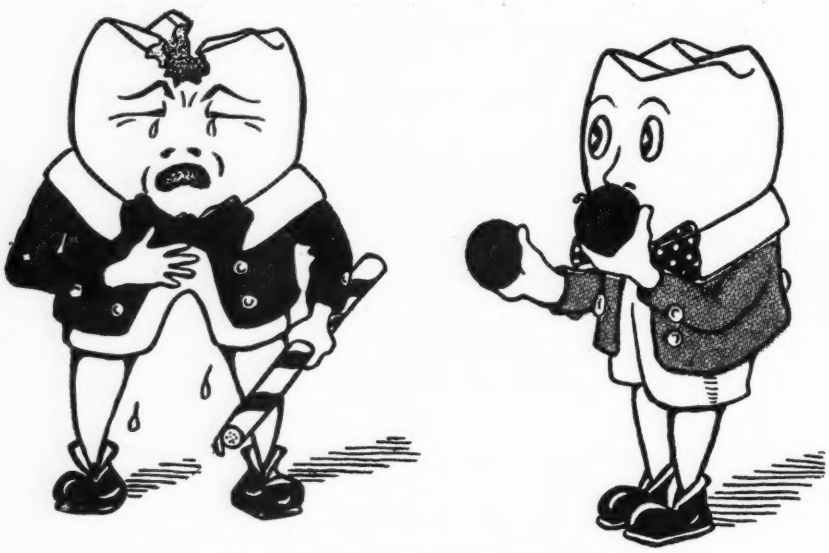

Fig. 2.—When you crave candy, eat some fruit.

Fig. 3.

with an amazing simplicity, but at the same time accurately enough. Even the overbite is discussed and the influence of malocclusion upon the facial expression is demonstrated.

Despite the simplicity of language, it is questionable whether children would enjoy reading the book as they would a fairy tale; but if it is kept in the waiting room, they are likely to pick it up and glance through it. Then they will be fascinated by the humorous illustrations which depict each tooth as a human being with human feelings, human joys and human ailments (Fig. 3).

If the children will not read the little volume through conscientiously, the adults certainly will. There is hardly another book written on the subject of dentistry which is so easy to understand for the lay person and which is so accurate. It should do excellent educational work among our patients.

We, ourselves, might gain some advantages from it by following its simple method of explanation when we speak to our patients. They have had no four-year dental course and no orthodontic postgraduate instruction to understand our technical terms. A "Class II" is as mysterious and meaningless to them as the oracle of Theben. Still, they come to us for information and advice. They should have both in a simple and convenient form. Dr. Ferguson's book will, no doubt, be a help in accomplishing this objective.

E. N.

THE FORUM

Articles for this department should be sent to Dr. Albert H. Ketcham and Dr. William R. Humphrey, 1232 Republic Bldg., Denver, Colo.

Are We Progressing?

Have you ever examined the mouth of a three-year-old child and found a gob of amalgam or cement forced down into the interproximal space between the mandibular first and second deciduous molars, completely filling the interproximal space and presumably serving as a filling for a distoclusal cavity in the first deciduous molar and possibly a mesioclusal cavity in the second deciduous molar? Did you then radiograph these teeth and observe the wad of amalgam which had been forced between the gingival margins of the cavity and under the bulge of the tooth to provide a beautiful saw edge and overhang for the laceration of these interproximal tissues, and after observing these pictures did you wonder whether the man who had placed that plug (it could not be called a filling or restoration) had ever examined an extracted first deciduous molar or studied the external and internal anatomy of this tooth?

Perhaps you have then inserted an instrument into the interproximal space beneath this filling and worked it gently up and down but failing to remove it (because of undercuts placed under the buccal and lingual enamel walls with a spoon excavator) you have continued to jiggle it up and down while you marveled at what a very efficient plunger it was for the forcing of saliva, food débris, and bacteria into an already deep cavity and upon a long suffering pulp. Possibly after observing this dental tragedy, this wanton abuse of an innocent child and his trusting parent, you have wondered whether the profession has really made any progress in the last thirty years in anything but plate and bridge work. Then as a final blow you may have learned that the work was placed, not by a quack or advertiser as you may have supposed, but by one of the leading men in the profession, whose restorations for his adult patients you know to be excellent, and then you have asked yourself one question, *Why* this class of work by such a man? Perhaps after the plug was removed from the little patient's tooth and he had been made comfortable and dismissed until a future appointment, you have sat at your desk and sought the answer to your question, and thoughts like these may have run through your mind:

1. Was it the desire for financial return? Possibly, although he probably lost money on the case.
2. Was it fear that the parents might think him incompetent if he referred the case? Also possible, for the child was from one of his good families.

3. Was it ignorance of the anatomy of the deciduous teeth? Yes, his work showed that plainly.
4. Was it ignorance of the basic principles of cavity preparation? No, for he places excellent restorations for his adult patients.

And with this you close your office door and start for home with your question still unanswered but with a lingering suspicion in your mind that this prominent dentist still had a feeling that deciduous teeth were not important, would soon be lost, and hence their careful restoration was not necessary.

Paul A. Barker.

The Dentist's Problem

A serious problem confronts a general practitioner when called upon to treat children's teeth for malocclusion. The patients believe, because the dentist can fill teeth and make a bridge or plate, that he should be able to make appliances to straighten crooked teeth. The average dentist is afraid he might forfeit the confidence of his patients, for whom he has worked for years, if he does not profess ability to "straighten teeth."

Moreover it is difficult to convince the average patient that it is necessary for the dentist to take a special course of study in preparation for this work; that orthodontia is a specialty which requires careful study of the development of the child, followed by a thorough diagnosis of the deviations from normal in the growth of the jaws and tooth positions. It is also hard to make the patient understand that movement of the teeth, shaping the appliance, expanding the arches to make room for the various teeth that are to be brought into place, and the safe amount of pressure exerted by an appliance upon the teeth and supporting structures, are best determined by the specialist.

In small communities, especially, the average person looks askance at the expense of having this work performed by an orthodontist, plus the expense of visiting him an average of once a month. The patient will mention a neighbor who is having a boy or girl treated by Dr. Blank who is not an orthodontist and whose fee is very reasonable. What is the average dentist to do? As a rule he feels sorry for his patient and giving in to the patient's demands, takes a set of impressions and sends it to a laboratory for some sort of an appliance. It is returned to the dentist with instructions for treating the case, with the natural and usual result that more harm than good is done. Therefore, I truly believe that there should be an orthodontist in every community which supports from fifteen to twenty dentists. This may eliminate the problem in these communities.

Peter Appel, Jr.

Help the Gagging Patient

After the usual applications of local anesthetics to the palate and tongue had failed to arrest an extreme case of gagging during a radiodontic examination, pause was given to consider the probable causes—perhaps the nerve terminals and taste buds were repelling articles which were not food, so we decided to fool them. Chocolate flavored malted milk powder was sprinkled over and under the back part of the tongue and the child instructed to eat it. Additional powder was sprinkled on the film. This procedure was repeated with successive films without gagging recurring.

The same plan has since been followed in many similar cases with a high degree of success.

A. H. K.

What Is Orthodontic Treatment?

The parents of prospective orthodontic patients sometimes ask what constitutes correct orthodontic treatment. We usually answer as follows:

Broadly speaking, correct orthodontic treatment consists in developing both upper and lower dental arches to normal size and form; the placing of each tooth in correct relation to its neighbors and also to the teeth with which it should function in the opposing dental arch.

The desired result is attained through gentle pressure applied to the teeth, and transmitted to the tissues supporting the roots of the teeth, thus simulating growth of these tissues. Through the attainment of the above ideal, the masticatory apparatus reaches its highest degree of efficiency. The teeth are more readily cleaned, thus less likely to decay, and the surrounding tissues are less liable to suffer from disease.

Furthermore, in the great majority of cases, it is only through following this procedure that the highest degree of beauty of teeth and features is attained.

A. H. K.

Orthodontia and Prophylaxis

In children's dentistry orthodontia and prophylaxis must go hand in hand. It matters not how skillfully and successfully the former has been accomplished, if the tooth structures and investing tissues have been neglected, the ultimate result leaves much to be desired. A child whose teeth are fitted with bands, arches and ligatures will of necessity have greater difficulty in maintaining a clean mouth. So in addition to annual radiographic "check-ups," a recementing of the bands, and periodic prophylaxis, the parents should be advised of the importance of home care and diet for the little patient. Theirs should be the responsibility of supervising the child's brushing after each meal to remove the food which has lodged upon the teeth and the orthodontic appliances. Failure to do so means that eventually there will

be an etching and decalcifying of the enamel. These roughened surfaces may result in cavities, or act as irritants which later produce initial periodontal lesions.

The best results can be attained with a small brush and some bland dentifrice, using a rolling motion with the brush from the gums to the teeth for about three minutes. Instead of brushing haphazardly the child should be taught a systematic routine so that every tooth will receive adequate attention. This, by repetition, will gradually become a habit. In areas where the brushing will not suffice, dental tape or a toothpick may be used. Care must be used not to bruise the soft tissues.

M. Giesecke.

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EDITORIALS

Dr. Henry A. Baker and the Baker Anchorage

IN THE passing of Dr. Henry A. Baker the science of orthodontia has again lost one of its outstanding pioneers. He might be classed as one of the stalwarts, which included Case, Angle, Kingsley, Bogue, Guilford, Farrar, a group of men who made something more than a means of livelihood of their profession. They looked upon their occupation somewhat as a religion, and they made an effort to put a great deal into it as well as to take something out.

By the group of younger orthodontists, Dr. Baker is probably best remembered as the man who contributed one of the most important principles of mechanotherapy—the intermaxillary elastics. Later this has been better known as the Baker anchorage.

As far back as 1893, the year of the first World's Fair in Chicago, Dr. Baker received the inspiration that made it possible to correct Class II and Class III malocclusions, that is, to jump the bite (as it was then called) by using small rubber bands known to the rubber trade as election bands. He did this operation quite consistently and successfully, and some years later the late Dr. Edward H. Angle said: "To the best of my knowledge and belief we are indebted to Dr. H. A. Baker of Boston for this idea, he having used it in the retraction of the protruding incisors of his son." It was then called the Baker anchorage.

Forty-one years have passed since the Baker anchorage was introduced as an important requisite to the treatment of malocclusion; even so, the anchorage is probably used more extensively today than ever before. Sporadic efforts, from time to time, to supplant it by newer and simpler methods have been unsuccessful; the anchorage is still important and probably will be for many years to come.

The Baker anchorage is now better understood mechanically than it was when introduced by Dr. Baker in 1893, and it has been said by many that to underestimate the efficacy of this anchorage in orthodontic treatment is an error the orthodontist should be cautious not to make.

Orthodontists everywhere should use the terminology "Baker anchorage" as a tribute to the memory of a man who made an important contribution to the science in its infancy. Had Dr. Henry Baker not lived, orthodontia would not have been so far advanced as it now is. Dr. Baker is another important orthodontic pioneer who has passed away during the last four years, with many others, who represent the first generation of modern orthodontists as specialists. He leaves his son Lawrence, who is professor of orthodontia in Harvard University and who was an orthodontic protegé of his father and the late Dr. Edward A. Angle. He also leaves a host of orthodontic friends and admirers to mourn his loss.

H. C. P.

Resolutions About Appliances

TWO more orthodontic societies, the Southern Society of Orthodontists, in regular annual meeting assembled at Hot Springs, Va., on July 16, and the Southern Section of the Pacific Coast Society of Orthodontists, in regular meeting at Los Angeles on September 14, registered their disapproval and condemnation of the mail order system of orthodontic practice as being detrimental to the public welfare.

These societies adopted resolutions condemning the exploitation methods used by certain laboratories in their mail order diagnostic and treatment methods as a professional menace which should be stopped. The laboratories to which this resolution is directed will probably think or say in answer, "The reason we laboratories make orthodontic appliances for the dental profession is that the dental profession orders them from us and asks our advice as to treatment and, further, the dental profession is licensed to practice

orthodontia, in all states in America save one; therefore we are, of course, entirely within our rights in supplying this demand for orthodontic appliances and treatment."

Orthodontists will not be much impressed by that logic; they might say that the Navajo Indian medicine man still treats gangrene by applying copious quantities of pine pitch over the raw and decomposed area, but journals which serve the medical profession would not, of course, attempt to advocate this treatment in their advertising pages in 1934, because their readers would feel this type of advertising inconsistent with the scientific articles contained in the text pages of the journals, and unfair to the authors of such articles.

Some of the instructions being freely dispensed to members of the dental profession for their orthodontic cases by untrained, amateurish, self-appointed "authorities" connected with some laboratories are so utterly ridiculous that orthodontists must be commended for finally protesting, in unison, against this crude affront to their specialty, upon which years and years of scientific research have been done by some of the most brilliant men, some of the most sincere and conscientious workers the profession of dentistry has ever produced. It is time that somebody should protest this lowering of a highly meritorious work in justice to the public and in fairness to the dental profession.

H. C. P.

Resclutions of the Southern Society of Orthodontists*

Mail Order Orthodontia Laboratories

WHEREAS dentistry is being exploited by commercialized orthodontia in the form of mail order diagnostic and treatment laboratories, which are a public and professional menace to the present-day standards of orthodontia practice; and

WHEREAS large numbers of these firms are advertising appliances now considered obsolete and unreliable in the hands of the general practitioner; and

WHEREAS the advertisements of these laboratories misrepresent orthodontia by making misleading statements and offer different inducements in gathering mailing lists of prospective customers to circularize with false and unwarranted assertions about orthodontia; and

WHEREAS some of these laboratories are operated by technicians who were never graduated from a dental college or never became licensed practitioners; and

WHEREAS the system is but a malicious method of selling appliances and contrary to the rules of professional ethics; and

WHEREAS their pretensions and system can only be recognized as a form of dental quackery, which violates the intents and purposes of state laws regulating the practice of dentistry; therefore be it

Resolved That the members of the Southern Society of Orthodontists, in regular annual meeting assembled at Hot Springs, Virginia, on July 16, 1934, register their disapproval and condemn the mail order system of orthodontia practice as being detrimental to the best interests of the welfare of the public seeking orthodontia service; and

Resolved That a copy of these resolutions be spread on the minutes of the Society and a copy sent to the publishers of all proprietary dental journals urging them to discontinue this type of advertising; and

Resolved That a copy of these resolutions be sent to all officers of the American Dental Association and the American Society of Orthodontists.

*These resolutions were also adopted by the Southern Section of the Pacific Coast Society of Orthodontists, at the regular meeting held September 14 in Los Angeles.

BOOK REVIEW

Mouth Hygiene

A Text-Book for Dental Hygienists. By Alfred C. Fones, D.D.S. Published by Lea & Febiger, Philadelphia, fourth edition, 219 illustrations.

The purpose of this fourth edition remains the same as that of the previous editions. It presents briefly and simply to the dental hygienist the subjects relating to dentistry that are considered important to her training and education. It takes up the removal of deposits, stains and accretions from the exposed surfaces of the teeth and directly beneath the free margins of the gums. No attempt is made to describe in detail any other operative dental procedure.

Diet is given space as an important factor in general nutrition and in the maintenance of life and health. It is pointed out that many of the theories of dietetic principles have not been proved as yet so that they might be scientifically applied to the human body. Consequently, the conservative course of a varied and well-balanced diet is presented for the instruction and subsequent use of the dental hygienist.

It is within the operative and educational field, it is pointed out in this book, of the dental hygienist to reduce greatly some of the known local causes of three of the most prevalent forms of dental pathologic conditions. Dental prophylactic measures as carried out by dental hygienists are taken up from the standpoint of preventive dentistry movement.

The book devotes twenty-six pages, well illustrated, to the subject of orthodontic diagnosis and treatment of malocclusion. It is a very important book for the dental hygienist on the subject of mouth hygiene.

NEWS AND NOTES

Pacific Coast Society of Orthodontists

Plans are well under way for the next meeting of the Pacific Coast Society of Orthodontists which will be held in San Francisco in 1935.

The regular meeting of the Northern Section of the Pacific Coast Society of Orthodontists was held in Tacoma, Washington, Friday, June 15, 1934, in conjunction with the Washington State Dental Association meeting. This section endorsed the general plan of reorganization of the American Society of Orthodontists with reservation until more specific and detailed information of the plan is available.

The following program was presented:

Paper "The Importance of Diagnosis Before Treatment of Malocclusion." By Dr. H. L. Morehouse, Spokane.

Case Histories and Examination Data. Clinician, Dr. W. R. Dinham, Seattle.

Photographic Facial Reproduction. Clinicians, Dr. Geo. A. Barker, Seattle, and Dr. M. H. Fisher, Tacoma.

Plaster Denture Reproductions. Clinician, Dr. Paul D. Lewis, Seattle.

Radiographic Examination and Interpretation. Clinicians, Dr. F. E. Casey, Seattle; Dr. M. R. Chipman, Spokane; Dr. C. C. Mann, Seattle; and Dr. E. A. Bishop, Seattle.

Differential Diagnosis of Dentofacial Deformities. Clinician, Dr. H. N. Moore, Seattle.

The Central Section of the Pacific Coast Society of Orthodontists met at the Bellevue Hotel, San Francisco, June 12, 1934.

The subject of the meeting was Class II, Division 1 (Angle's Classification), and was discussed by many members of the organization. Discussion was opened by Dr. W. Sheffer with slides and explanations of just what Class II, Division 1 (Angle's Classification) entailed. Clinics were given with the presentation of models of various cases and the explanation of their diagnosis, treatment, results, retention, and their probable causes, by Dr. Hahn, Wolfsohn, and Lussier, Blake, Scott and some others were unable to give their presentations because of lack of time.

The Southern Section of the Pacific Coast Society of Orthodontists met June 8, 1934, in Los Angeles.

The Southern Section adopted resolutions to endorse the reorganization of the American Society of Orthodontists on a national basis in which the recognized sectional societies become the component societies.

Midwinter Meeting of Chicago Dental Society

The Midwinter Meeting of the Chicago Dental Society will be held February 18 to 21, inclusive, 1935, at the Stevens Hotel.

CARROLL W. STUART, Secretary
108 N. State Street
Chicago, Ill.

Notes of Interest

Dr. S. L. Kregarman announces the removal of his office to 30 West 59th Street, New York City. Practice limited to orthodontia.

Dr. Arthur V. Greenstein announces the removal of his New York office to 262 Central Park West. Practice limited to orthodontia.

Dr. Louis S. Winston announces the removal of his offices to 4115 Fannin Street, Houston, Texas. Orthodontia exclusively.

Dr. S. H. Yoffe announces the opening of his offices at 238 State Street, Harrisburg, Pa. Practice limited to orthodontia.

Dr. Adelbert Fernald, whose Boston office is at 29 Commonwealth Avenue, announces the removal of his Andover office to 107 Main Street, Andover, near Phillips Academy. Dr. Fernald is at his Andover office every Wednesday. Practice limited to orthodontia.

Erratum

Dr. Milo Hellman should be given credit as author of the first three paragraphs of the Report of the Research Committee of the American Society of Orthodontists, which appeared in the August issue, page 789.